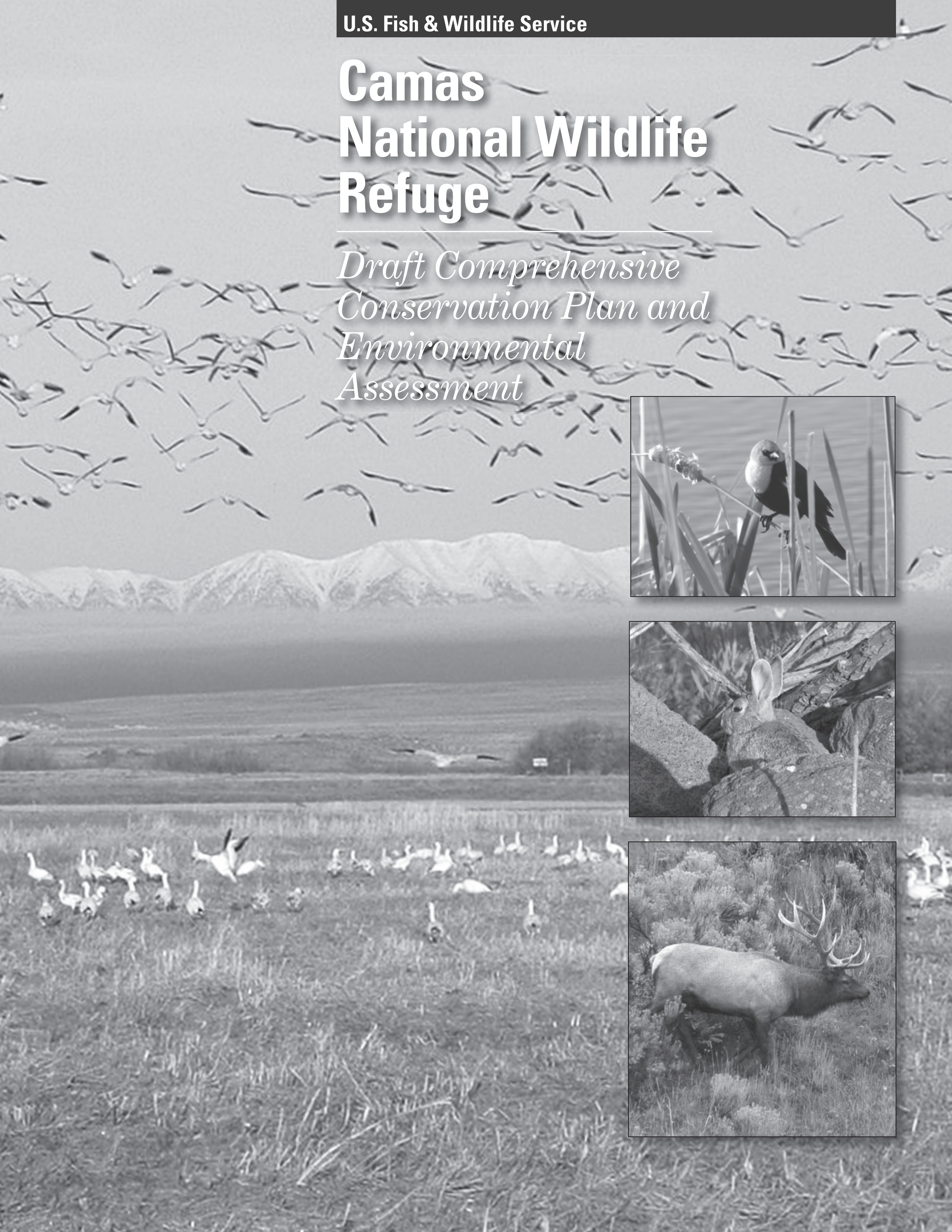
U.S. Fish & Wildlife Service

Camas National Wildlife Refuge

Draft Comprehensive Conservation Plan and Environmental Assessment



Our Vision for the Future

Long before Camas National Wildlife Refuge (NWR) was established in 1937 in eastern Idaho's high desert, wet meadows sustained by Camas Creek provided abundant insect life for waterbirds and sage-grouse to rear their broods. Sandhole Lake provided a year-round water source for pronghorn, mule deer, and people.

Today, much of the surrounding landscape has been transformed by agriculture. But Camas NWR still provides a serene setting where tundra swans glide on pools framed by a brilliant orange sunrise. Here visitors can see a pure white V of snow geese pressed against a brilliant blue sky, or search for rare warblers in the willows along Camas Creek. Photographers try their skill at capturing the fall ritual of a bull elk gathering his herd, and visitors even brave midwinter cold to watch bald eagles returning to roost in the Refuge's cottonwood trees.

Camas NWR will continue to provide wetland and sage-steppe habitat for migratory birds and other native wildlife. Here, people of all ages and abilities will have the opportunity not only to enjoy, but to better understand the habitats and wildlife of the eastern Snake River Plain, and the importance of natural systems. We will use water resources wisely and become a model for energy and water conservation. We will work with our partners to sustain functional ecosystems in a changing environment.

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

Sandhill cranes in flight. ©David Goeke

Camas National Wildlife Refuge

Draft Comprehensive Conservation Plan
and
Environmental Assessment

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Farrel Downs/USFWS

Chapter 1. Introduction and Background

1.1 Introduction

The Southeast Idaho National Wildlife Refuge Complex consists of four national wildlife refuges: Grays Lake, Bear Lake, Camas, and Minidoka; and the Oxford Slough Waterfowl Production Area. This CCP applies only to Camas National Wildlife Refuge (NWR, Refuge). The Grays Lake, Bear Lake, and Minidoka CCPs are being completed under separate planning efforts.

1.1.1 Camas National Wildlife Refuge

Camas Migratory Waterfowl Refuge* was established by Executive Order 7720 on October 8, 1937, in the high desert of Idaho's eastern Snake River Plain. The 10,806-acre Refuge lies within Jefferson County, near the small community of Hamer, 36 miles north of Idaho Falls at an elevation of about 4,800 feet. Much of the water needed to support the Refuge's wetlands and wet meadows is supplied by Camas Creek, which originates in the Centennial Range 40 miles to the northeast. The lower reach of Camas Creek cuts though the heart of the Refuge for about 8 miles, and terminates at Mud Lake just south of the Refuge.

Prior to the arrival of Euro-American settlers, the area now known as Camas National Wildlife Refuge was a diverse mosaic of sagebrush-steppe, grasslands, and seasonal to ephemeral wet meadows. Meadows along Camas Creek were shallowly inundated in spring, as the snowmelt-fed creek overtopped its banks. These meadows provided seasonal grazing for elk and bison, as well as nesting and brood rearing habitat for sandhill cranes and other birds. Later in the year the lower reach of Camas Creek could run dry, but at the site of present day Sandhole Lake, artesian flow from perched groundwater reached the surface, providing wildlife and people with a reliable water source in an otherwise arid and unpredictable environment. Although the area was never permanently inhabited, it did lie along an important travel route leading to the camas meadows near present-day Kilgore, Idaho, and to the buffalo hunting grounds of central Montana. Members of several tribes passed through the area regularly, and sometimes camped for short periods. The Shoshone and Bannocks were the most frequent users of the lands within the present-day Camas NWR as a travel corridor.

The first Euro-Americans arrived shortly after the exploration of Lewis and Clark, who passed less than 100 miles north of the Refuge. The first to arrive were trappers, traders, and then missionaries. The first large influx of settlers came with the discovery of gold in western Montana in the 1860s. About this time, a wagon and stage road was established between the railhead at Corrine, Utah, across the Snake River Plain to Monida Pass on the Idaho-Montana border, and on to the gold fields in Montana. A short segment of this wagon and stage road passed through what is now Camas Refuge. One of the many overnight stage stops was located at "Sandhole" (now Sandhole Lake) in the southeast corner of the refuge.

Agriculture initially developed in the area to support the thousands of people working the mines, as well as travelers on the wagon roads. Agriculture expanded in southeast Idaho after the Federal

*The name of the Refuge was changed to Camas National Wildlife Refuge on July 25, 1940 (Presidential Proclamation 2416).

government enacted a series of acts to encourage homesteading in arid and semiarid regions of the West: the Desert Land Act of 1877, the Desert Land Act of 1894 (Carey Act) and the Reclamation Act of 1902. By the early 1880s the railroads had come, connecting farmers and ranchers to markets far beyond rural Southeast Idaho. In the 1890s settlers began claiming homesteads for ranches and farms within the Camas NWR boundary area. The first land patent on the Refuge was for 319 acres by Humphrey Toomey in August 1889. In all, sixty-one land claim patents were filed on the present-day Camas NWR between 1890 and Refuge establishment.

The Carey Act made it possible for enormous tracts of previously arid lands to be opened up for agricultural use through complex irrigation projects. Under this Act, the so-called “public land states” with desert lands were offered one million Federal acres each, provided they would cause the granted lands to be irrigated. Over a period of 40 years, the State of Idaho received 618,000 acres of previously desert land. Carey Act reclamation projects put substantial tracts of land under cultivation in and around the area that is now Camas National Wildlife Refuge.

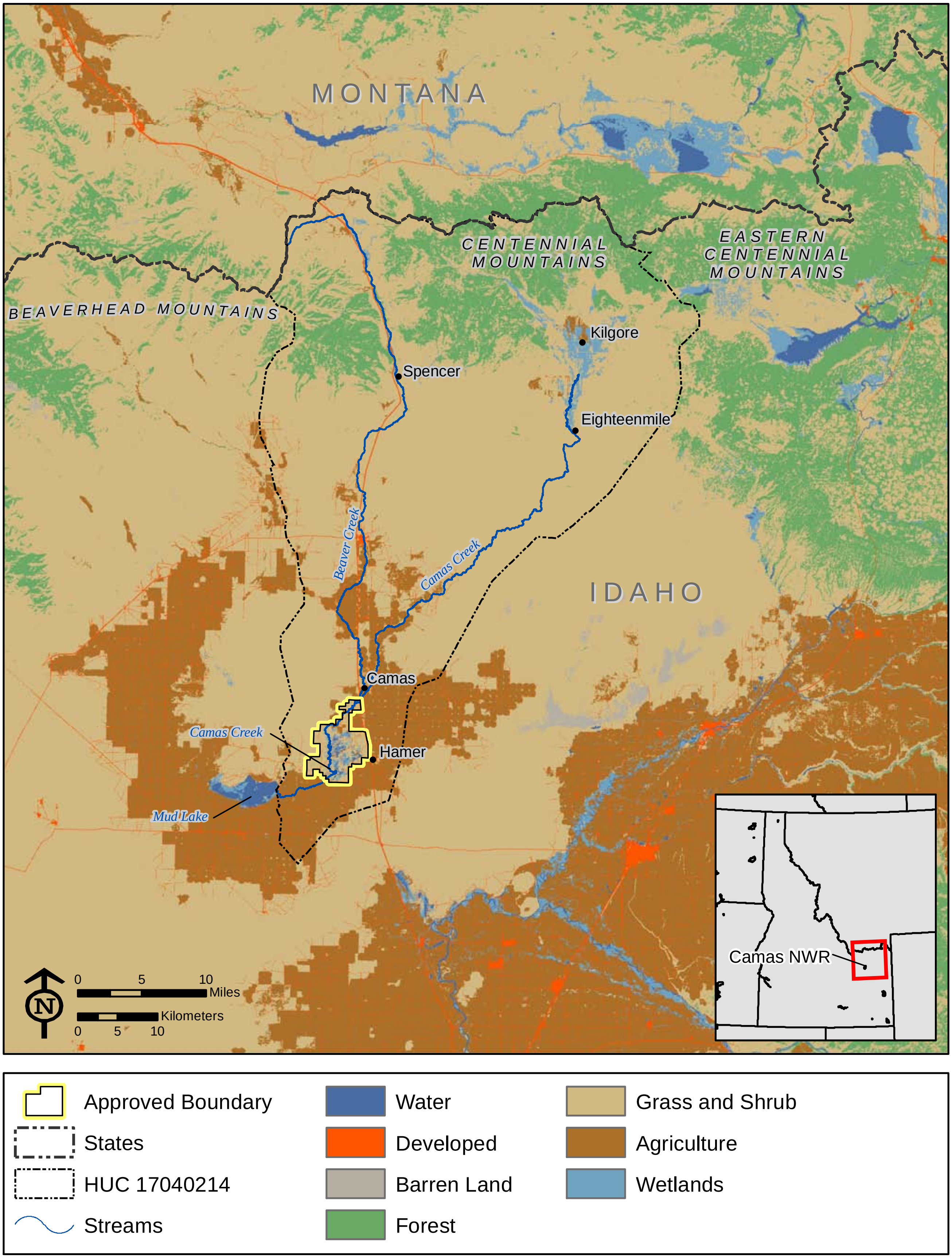
In the early 1900s, a large reclamation project on the Egin Bench, 15 miles to the east, had a major effect on the hydrology of the Camas/Mud Lake area. Subirrigation of the Bench, intended to raise the local water table, created a huge body of subsurface water, some of which leaked to the north and then to the west, ultimately arriving in the Mud Lake Basin. The character of the present-day Refuge rapidly changed from dry to wet. Low swales became marshy, Rays Lake (formerly dry) filled, and Sandhole Lake swelled to its present size. By 1921, much of the present-day Refuge had become too wet to farm, and many of the original homesteaders sold out.

While the area that eventually became Camas NWR was mostly too wet for crops, it continued to provide pasturage and hay fields for livestock. By the time the Refuge was established, much of its lands were owned by Idaho Livestock Lands Inc. A diverse suite of waterfowl and waterbirds also benefitted from the expansion of wetlands brought by the rising water table. Widespread drought in the 1930s led to the protection of many waterfowl breeding areas as National Wildlife Refuges, including Camas NWR. Shortly after the Refuge was established, crews from the Works Progress Administration (WPA) constructed the refuge headquarters buildings, water control structures, and bridges. This work is still evident and in use today.

With the expansion of center pivot irrigation on the eastern Snake River Plain and cessation of flood irrigation on the Egin Bench, water tables in the Camas area have dropped 15 to 20 feet since the 1980s. Wetlands that once perched on saturated soils have become difficult to maintain, and many are now classified as inactive. Increasingly, Refuge staff have been forced to look at new strategies for managing wetland habitat.

Today, the Refuge supports significant concentrations of migrating waterfowl, as well as resident elk, white-tailed deer, mule deer, pronghorn, and moose. There are 292 known species of wildlife that use the Refuge during various periods of the year. During migration, which peaks during March and April, and again in October, up to 50,000 ducks, 3,000 geese, and several hundred tundra and trumpeter swans may be present on the Refuge. Approximately 100 species of migratory birds nest at the Refuge, and it is especially important to migrating land birds. A large number of songbirds use the Refuge’s cottonwood groves, which are also a significant winter roost site for bald eagles. Greater sandhill cranes gather on the Refuge prior to fall migration. Sage grouse use the Refuge during brood rearing. The Refuge provides excellent opportunities for wildlife viewing and photography, and is well known in the birding community as a place to spot rare warblers and other migrating landbirds in the spring.

Map 1. ***Camas NWR - Regional Overview***



Map Date: 2/3/2012 File: Map1_CMS_RegionalOverview.mxd
Data Source: USGS 1:24,000 National Hydrography Dataset, USGS NLCD 2006.

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1.2 Proposed Action

We, the U.S. Fish and Wildlife Service (Service), manage Camas NWR as part of the National Wildlife Refuge System. We propose to adopt and implement a Comprehensive Conservation Plan (CCP) for the Refuge. This document is the Refuge's Draft Comprehensive Conservation Plan and Environmental Assessment (Draft CCP/EA). 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 et seq.) as amended by the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57). The Administration Act requires CCPs to identify and describe:

- The purposes of the refuge unit;
- The fish, wildlife and plant populations, their habitats, and the archaeological and cultural values found on the refuge unit;
- 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.

National Wildlife Refuge System (Refuge System) planning policy (Service Manual Part 602, 602 FW 3, June 21, 2000) states that the purpose of CCPs is to: "describe the desired future conditions of a refuge and provide long-range guidance and management direction to achieve refuge purposes; help fulfill the National Wildlife Refuge System mission; maintain and, where appropriate, restore the ecological integrity of each refuge and the Refuge System; … and meet other mandates."
The Service has developed and examined alternatives for future management of Camas NWR through the CCP process. The various alternatives address the major issues and relevant mandates identified during the process and are consistent with the principles of sound fish and wildlife management. We evaluated three alternatives for the Refuge's Draft CCP/EA and selected Alternative 2 as the preferred alternative.

The draft 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 units consistent with the sound principles of fish and wildlife management. However, the draft preferred alternative may be modified between the draft and final documents depending upon comments received from the public or other agencies and organizations. The Service's Regional Director for the Pacific Region will decide which alternative will be implemented. For details on the specific components and actions constituting the range of alternatives, see Chapter 2.

1.3 Purpose and Need for the CCP

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1.4 Content and Scope of the CCP

This Draft CCP/EA provides guidance for management of refuge habitats and wildlife and administration of public uses on refuge lands and waters. This Draft CCP/EA is intended to comply with both the Refuge System Administration Act and the National Environmental Policy Act (NEPA), as amended (42 U.S.C. 4321-4347). The Draft CCP/EA includes the following information.

- An overall vision for the Refuge and its role in the local ecosystem (Chapter 1).
- Goals and objectives for specific habitats, research, inventory, monitoring, and public use programs, as well as strategies for achieving the objectives (Chapter 2).
- A description of the Refuge's physical environment (Chapter 3).
- A description of the Refuge's wildlife species and species groups identified as priority resources of concern and their habitats; their condition and trends on the Refuge and within the local ecosystem; the desired ecological conditions for sustaining them, and a short analysis of threats to resources of concern and their habitats (Chapter 4).
- A description of the Refuge's historic and cultural resources, socioeconomic environment, administrative and public use facilities, and public use programs (Chapter 5).
- An analysis of the effects of the proposed action as compared to current management, including cumulative effects (Chapter 6).
- Evaluations of existing and proposed public uses for appropriateness and compatibility with the Refuge's purposes (Appendices A and B).
- An outline of the projects, staff and facilities needed to support the alternatives considered (Appendix C).

1.5 Refuge Planning and Management Guidance

The Refuge is managed as part of the Refuge System within a framework provided by legal and policy guidelines. This Draft CCP/EA is primarily guided by the provisions of the mission and goals of the Refuge System, the purposes of the Refuge as described in its acquisition authority, Service policy, and Federal laws. The following summaries are provided as background for the Draft CCP/EA.

1.5.1 The U.S. Fish and Wildlife Service

The Refuge is 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 and wildlife 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

The Service manages the 150-million-acre Refuge System. The Refuge System is the world's largest network of public lands and waters set aside specifically for conserving wildlife and protecting ecosystems. From its inception in 1903, the Refuge System has grown to encompass more than 550 national wildlife refuges; thousands of small wetlands and other special management areas; and millions of acres of islands and their surrounding marine environments in remote areas of the Pacific Ocean. The needs of wildlife and their habitats come first on refuges, in contrast to other public lands that are managed for multiple uses.

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.)*

Wildlife conservation is the fundamental mission of the Refuge System. The goals of the Refuge System, as articulated in the Mission Goals and Purposes Policy (Service Manual Part 601 [601 FW 1]) are to:

- 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 Camas 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. 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 603 FW 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 nonwildlife-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 proposed uses for the Camas Refuge are in Appendices A (Appropriateness) and B (Compatibility) of this Draft CCP/EA.

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 Biological Resource Protection Acts

The Refuge's plant and animal species are protected under several Federal laws, including the following.

Endangered Species Act of 1973 (16 U.S.C. 1531-1544). Through Federal action and by encouraging the establishment of state programs, the 1973 Endangered Species Act (ESA) provided for the conservation of ecosystems upon which threatened and endangered species of fish, wildlife, and plants depend. The ESA:

- Authorizes the determination and listing of species as endangered and threatened;
- Prohibits unauthorized taking, possession, sale, and transport of endangered species;
- Provides authority to acquire land for the conservation of listed species, using land and water conservation funds;

- Authorizes establishment of cooperative agreements and grants-in-aid to States that establish and maintain active and adequate programs for endangered and threatened wildlife and plants;
- Authorizes the assessment of civil and criminal penalties for violating the act or regulations; and
- Authorizes the payment of rewards to anyone furnishing information leading to arrest and conviction for any violation of the act or any regulation issued there under.

Section 7 of the ESA requires Federal agencies to ensure that actions authorized, funded, or carried out by them are not likely to jeopardize the continued existence of listed species, or modify critical habitat. For candidate species and species of concern, refuge management activities are focused on protecting habitat and reducing threats so that these species do not need the protection of the ESA.

Both the Service and the National Marine Fisheries Service (NMFS) implement and enforce the ESA. The Service has primary responsibility for terrestrial and freshwater organisms, while NMFS has jurisdiction over most marine and anadromous fish listed under the ESA. No ESA listed species occur on the Refuge; however, several State of Idaho species of the greatest conservation need are found on the Refuge and are described in Chapter 4, Biological Environment.

Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712). The framers of the Migratory Bird Treaty Act were determined to put an end to the commercial trade in birds, and their feathers, that by the early years of the 20th century had wreaked havoc on the populations of many native bird species. The Migratory Bird Treaty Act decreed that all migratory birds and their parts (including eggs, nests, and feathers) were fully protected. It is the domestic law that affirms or implements the United States' commitment to four international conventions (with Canada, Japan, Mexico, and Russia) for the protection of a shared migratory bird resource. Each of the conventions between two nations protect selected species of birds that are common to both countries (i.e., they occur in both countries at some point during their annual life cycle). All of the Refuge's bird species are protected under this act, with the exception of nonnative species (European starling, house sparrow, and rock dove).

1.5.4 Tribal Consultation

Since the inception of the United States, the U.S. Government has recognized the sovereignty of American Indian Tribes by entering into treaties with them. Moreover, the Constitution ascribes the official duties of conducting relations with the Tribes to the Federal Government, not the states, and judicial decisions have upheld this relationship over time. This government-to-government relationship provides the framework for all interactions between the U.S. Government and American Indian Tribes. Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments, Nov. 6, 2000) directs Federal agencies to consult with Federally recognized Tribes at the government-to government level. Therefore, the U.S. Fish and Wildlife Service, as a federal agency, must consult with Tribes on any matter that may affect tribal treaty rights and interests.

The Secretary of the Interior announced a new Tribal consultation policy on December 1, 2011. This new policy sets out detailed requirements and guidelines for Department of the Interior officials and managers to follow to ensure they are using the best practices and most innovative methods to achieve meaningful consultation with federally recognized Tribes. Any regulation, rulemaking, policy, guidance, legislative proposal, grant funding formula change or operational activity that may have a substantial and direct effect on a Tribe is subject to Tribal consultation.

The Service developed and adopted a Native American Policy in 1994. The Service's purpose in creating this policy is to "articulate the general principles that will guide the Service's government-to-government relationship to Native American governments in the conservation of fish and wildlife resources." Key provisions of the Native American Policy of the U.S. Fish and Wildlife Service include:

- The Service recognizes the sovereign status of Native American governments.
- There is a unique and distinctive political relationship between the United States and Native American governments…that differentiates Native American governments from other interests and constituencies.
- The Service will maintain government-to-government relationships with Native American governments.
- The Service recognizes and supports the rights of Native Americans to utilize fish and wildlife resources on non-reservation lands where there is a legal basis for such use.
- While the Service retains primary authority to manage Service lands, affected Native American governments will be afforded opportunities to participate in the Service's decision-making process for Service lands.
- The Service will consult with Native American governments on fish and wildlife resource matters of mutual interest and concern to the extent allowed by the law. The goal is to keep Native American governments involved in such matters from initiation to completion of related Service activities.
- The Service will involve Native American governments in all Service actions that may affect their cultural or religious interests, including archaeological sites.
- The Service will provide Native Americans reasonable access to Service managed or controlled lands and waters for exercising ceremonial, medicinal, and traditional activities recognized by the Service and by Native American governments. The Service will permit these uses if the activities are consistent with treaties, judicial mandates, or Federal and Tribal law and are compatible with the purposes for which the lands are managed.

The Shoshone-Bannock Tribe is a federally recognized Tribe, some of whose constituent Tribes or bands are descendants of people who historically used the Refuge area. The Shoshone-Bannock Tribe has a treaty negotiated with the United States government (the Fort Bridger Treaty of July 3, 1868 between the United States and the Eastern Band of Shoshone and Bannock Tribes, ratified on February 24, 1869, 15 Stat. 209 [p. 673]). The treaty authorized the President to establish a reservation for the Bannock and certain Shoshone bands. Article 4 of the treaty also states: "The Indians herein named…shall have the right to hunt on the unoccupied land of the United States so long as game may be found thereon…." In 1936, The Shoshone-Bannock Tribes adopted a constitutional form of government that established the seven-member Fort Hall Business Council, elected by tribal members living on the reservation. The council regulates business and other activities on the reservation according to the Law and Order Code, and other ordinances.

1.5.4 Historic Preservation Acts

The Refuge's historic resources are protected under several Federal laws.

Archaeological Resources Protection Act of 1979, as amended (16 U.S.C. 470aa-470ll). The Archaeological Resources Protection Act largely supplanted the resource protection provisions of the

Antiquities Act of 1906 for archaeological items. This act established detailed requirements for issuance of permits for any excavation for or removal of archaeological resources from Federal or Indian lands. It also established civil and criminal penalties for the unauthorized excavation, removal, or damage of any such resources; for any trafficking in such resources removed from Federal or Indian land in violation of any provision of Federal law; and for interstate and foreign commerce in such resources acquired, transported, or received in violation of any state or local law.

Public Law 100-588, approved November 3, 1988, (102 Stat. 2983) lowered the threshold value of artifacts triggering the felony provisions of the act from $5,000 to $500, made attempting to commit an action prohibited by the act a violation, and required the land managing agencies to establish public awareness programs regarding the value of archaeological resources to the Nation.

Archaeological and Historic Preservation Act of 1960, as amended (16 U.S.C. 469-469c). To carry out the policy established by the Historic Sites Act, this Archaeological and Historic Preservation Act directed Federal agencies to notify the Secretary of the Interior whenever they find that a Federal or federally assisted, licensed, or permitted project may cause loss or destruction of significant scientific, prehistoric, or archaeological data. The act authorized use of appropriated, donated, and/or transferred funds for the recovery, protection, and preservation of such data.

Historic Sites, Buildings and Antiquities Act of 1935 (16 U.S.C. 461-462, 464-467). This act declared it a national policy to preserve historic sites and objects of national significance, including those located on refuges. It provided procedures for designation, acquisition, administration, and protection of such sites. National Historic and Natural Landmarks are designated under authority of this act.

National Historic Preservation Act of 1966 (16 U.S.C. 470-470b, 470c-470n). This act provided for preservation of significant historical features (buildings, objects, and sites) through a grant-in-aid program to the states. It established a National Register of Historic Places and a program of matching grants under the existing National Trust for Historic Preservation (16 U.S.C. 468-468d). The act established an Advisory Council on Historic Preservation, which was made a permanent independent agency in Public Law 94-422, approved September 28, 1976 (90 Stat. 1319). That act also created the Historic Preservation Fund. Federal agencies are directed to take into account the effects of their actions on items or sites listed or eligible for listing in the National Register. As of September 2004, 157 historic sites on national wildlife refuges had been placed on the National Register.

Camas Refuge has several sites that are potentially eligible for placement to the National Register of Historic Places. The three original refuge buildings built during the Works Progress Administration Camp are eligible for the National Register. Five other sites found during a cursory cultural survey of some refuge areas documented five other potential National Register of Historic Places sites, including a stone circle, two historic canals, a historic trash dump, and an irrigation canal. Other potentially eligible sites may include refuge bridges, water control structures, dikes, and the Brindley cabin.

Native American Graves Protection and Repatriation Act of 1990 (25 U.S.C. 3001-13). This Act establishes requirements for the treatment of Native American human remains and sacred or cultural objects found on Federal land. In any case where human remains or funerary objects can be associated with specific Tribes or groups of Tribes, the agency is required to provide notice of the item in question to the Tribe or Tribes. Upon request, each agency is required to return any such item to any lineal descendant or specific Tribe with whom such item is associated.

Executive Order 11593 Protection and Enhancement of the Cultural Environment. Signed May 6, 1971, Executive Order 11593 requires that the Federal government provide leadership in preserving, restoring, and maintaining the historic and cultural environment of the Nation. Agencies of the executive branch of the government must:

1. Administer the cultural properties under their control in a spirit of stewardship and trusteeship for future generations;
2. Initiate measures necessary to direct their policies, plans, and programs in such a way that federally owned sites, structures, and objects of historical, architectural, or archaeological significance are preserved, restored, and maintained for the inspiration and benefit of the people; and
3. In consultation with the Advisory Council on Historic Preservation, institute procedures to assure that Federal plans and programs contribute to the preservation and enhancement of nonfederally owned sites, structures, and objects of historical, architectural, or archaeological significance.

1.6 Refuge Establishment and Refuge Purposes

The Refuge Administration Act directs the Service to manage refuges to achieve their purposes. The purposes for which a refuge is established form the foundation for planning and management decisions. 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 proposed 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 these documents indicate otherwise, purposes dealing with the conservation, management, and restoration of fish, wildlife, and plants, and the habitats on which they depend take precedence over other purposes in the management and administration of any 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. The purposes for Camas Refuge are described below.

1.6.1 Summary of Purposes and Management Direction for the Refuge

The primary purpose of Camas National Wildlife Refuge, as derived from Executive Order 7720 (President Franklin D. Roosevelt, October 8, 1937), is:

- “ … as a refuge and breeding ground for migratory birds and other wildlife.” Executive Order 7720, dated Oct. 8, 1937.
- “ … for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” 16 U.S.C. § 715d (Migratory Bird Conservation Act)

- " … conservation, management, and … restoration of the fish, wildlife, and plant resources and their habitats … for the benefit of present and future generations of Americans …." 16 U.S.C. § 668dd(a)(2) (National Wildlife Refuge System Administration Act)

On July 25, 1940, the name of the Refuge was changed to Camas National Wildlife Refuge under Presidential Proclamation 2416, "Changing the Names of Certain Federal Wildlife Refuges."

1.6.2 Refuge Acquisition History and Authorities

The original boundary of the Refuge established in E.O. 7720 was "approximately 10,922 acres." Later surveys established the approved boundary at 10,726 acres. The boundary was expanded to include the 80-acre Bunker Hill tract in 2011; therefore the current approved boundary is 10,806 acres. The Refuge has ownership of all lands within its approved boundary with two exceptions, a 40-acre inholding and the 80-acre Bunker Hill tract (Tract 85). At the time of this writing, acquisition is pending on the Bunker Hill tract from its owner, Pheasants Forever. Map 2 shows current land status on the Refuge.

Table 1.1. Camas NWR Lands Purchased Through Fee Title Purchase

Tract Number	Acquired Date	Tract Owner	Interest of Acquisition	Acres
84	11/01/2005	Ball Lands L.C.	Fee	1.41
52	12/22/1938	Bramwell, Adna E.	Fee	230.49
71, 71a	5/10/1937	Brindley, George W.	Fee	795.76
80	10/1/1965	Brown, Rachel R.	Fee	121.30
61	7/8/1938	Brown, S.E.	Fee	160
82	5/5/1982	Bybee et ux, Don R.	Fee	80
74	11/12/1936	Clinton, Robert D.	Fee	80
77	5/28/1937	Clyne, Charles C.	Fee	120
57	9/13/1937	Davies, Benjamin T. et al.	Fee	40
58	7/16/1938	Ellis, G.W.	Fee	40
53	12/03/1936	Fielding, Joseph	Fee	160
81	2/8/1968	Flint, William L.	Fee	40
75, 75 I	3/4/1938	Haight, Glen	Fee	80
76	6/26/1937	Hall, Floyd W.	Fee	40
56, 56-I, 56a	6/29/1939	Helm, Ralph et al.	Fee	197.35
33, a, b-I	10/16/1936	Idaho Livestock Lands, Inc.	Fee	5137.08
33-I, 33-II, 33	6/7/1938	Idaho Livestock Lands, Inc.	Fee	1083.37
54	6/13/1938	Idaho Muskrat Corporation	Fee	280
64	7/22/1936	Jacques, Alpha R.	Fee	160
60	9/24/1936	Leavitt, Bertha M.	Fee	160
55	7/8/1938	Richardson, John	Fee	120
62	12/04/1936	Rostad, Sam R.	Fee	40
79	11/12/1936	Sanders, C. A.	Fee	320
83	6/23/1999	Sanders Family Trust	Fee	19.88
51	6/7/1938	Sargent, Mac et al.	Fee	89.51
59, 59a, 59a-I	8/4/1941	Smith, Mary T.	Fee	296.10
2	4/26/1938	State of Idaho	Fee	360

Table 1.1. Camas NWR Lands Purchased Through Fee Title Purchase

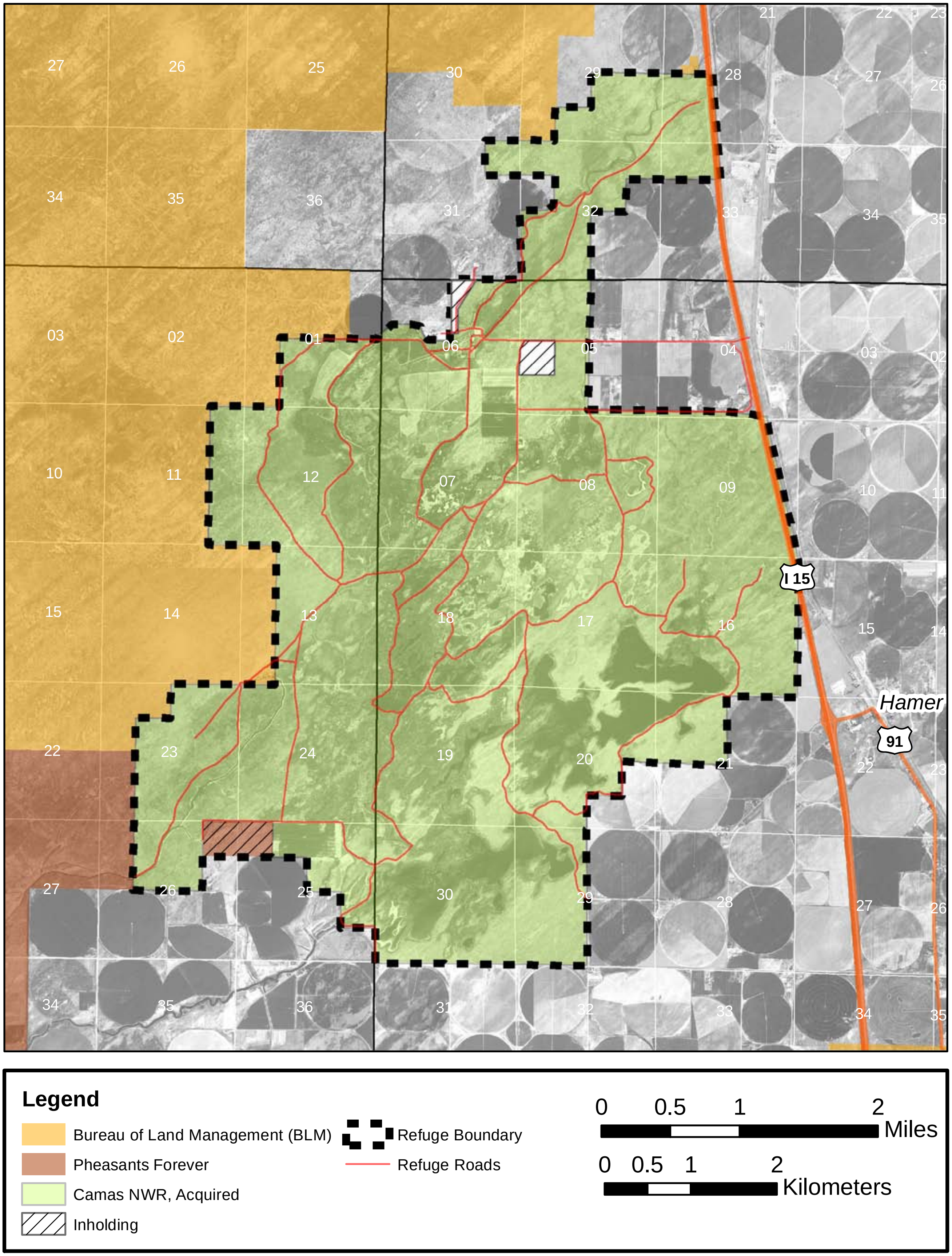
Tract Number	Acquired Date	Tract Owner	Interest of Acquisition	Acres
65	7/13/1938	Turman, Tabitha	Fee	160
66	2/3/1939	Woodard, Perry B.	Fee	320

Camas Land Exchanges

Camas NWR has executed four land exchanges since its establishment.

1. An exchange of 40 acres for a like 40 acres was executed on April 18, 1967 with William Flint (tract # 81).
2. An exchange of 159.94 refuge acres for 80 acres plus a sum of $5,700 was executed on May 27, 1981 with Don R. Bybee (tract #82).
3. An exchange of 19.88 acres for Refuge property of equal value was executed on June 23, 1999 with the David Ray Sanders Family Trust (tract #83).
4. An exchange of 1.41 acres for Refuge property of equal value was executed on November 1, 2005 with Ball Lands Limited Company (tract #84).

Map 2. ***Land Status***



Map Date: 5/31/2013 File:CCPMap_2_CMS_LandStatus_Oct11.mxd
Data Source:

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1.7 Relationship to Ecosystem Management Goals

1.7.1 Regional Setting

Camas NWR is located within the Intermountain West, a region comprising portions of eight states including eastern Washington and Oregon, northeast California, northern Nevada and Utah, western Wyoming and Montana, and Idaho. Due to its arid to semi-arid climate, wetlands are scarce in the region (Ratti and Kadlec 1992). Wetlands in the Intermountain West region account for about 1 percent of the surface area (1.6 million acres) compared to 6 percent (22.5 million acres) in the Midwest region (Dahl 1990).

Camas Refuge is located in the Basin and Range province, which occupies a small area of southern Idaho between the Middle Rocky Mountains and the Snake River Plain, west of the northern boundary of the Central Rocky Mountains. The Beaver-Camas Watershed encompasses the Refuge and is the eastern-most of the local Central Valleys watersheds that collectively make up the Sinks Drainages (Idaho Department of Environmental Quality [IDEQ] 2005). The Sinks Drainages are a collection of closed surface drainage basins in southeast Idaho. The streams of these basins originate in the Pioneer, Lost River, Lemhi, and Centennial mountain ranges and flow generally east and south, eventually sinking into the fractured basalts of the eastern Snake River Plain (Van Kirk et al. 2003).

The Beaver-Camas subbasin drains an area of 647,255 acres (1,011 square miles) within the Sinks Drainage and is bounded by the western edge of the Centennial Mountains and the Eastern Edge of the Beaverhead Mountains in the northern region of the subbasin. Beaver Creek and Camas Creek begin in the Centennial Mountains on the Idaho/Montana border and flow generally south and southwest, respectively. They converge just north of, and provide much of the water for, Camas National Wildlife Refuge. After exiting the Refuge, Camas Creek flows westward into Mud Lake, a natural playa “improved” with a dam forming a year-round impoundment (IDEQ 2005). Groundwater flow for irrigation eventually reaches Mud Lake, which is the endpoint for all drainage in the subbasin. Camas Creek is 303(d) listed for flow alteration, sediment, and nutrients (IDEQ 2005).

Mud Lake, three miles north of Terreton, Idaho, is an approximately 3,000-acre shallow (5 feet) lake authorized by the Flood Control Act of 1950 and formed by a 10-mile-long embankment constructed years ago by local farmers. The embankment confines the lake and provides water elevation so that irrigation canals can deliver water to farms. Originally the area was a natural sump where Camas Creek spread out and disappeared to groundwater. The area naturally extended several miles farther southeast, south, and west from its present area (IDEQ 2005). Water to fill Mud Lake comes from Camas Creek and pumping from wells by local irrigators (IDFG 1999).

The Beaver-Camas subbasin is rural, with very small towns located in Jefferson and Clark Counties. The largest town in the subbasin is Dubois with a population of 677 in 2010 (U.S. Census Bureau 2013). The two remaining towns with population data are Hamer and Spencer, with 2010 populations of 48 and 37, respectively (U.S. Census Bureau 2013). Land use in the Beaver-Camas subbasin is primarily agriculture with the majority of the watershed used for rangeland (64 percent). Forest lands are located at higher elevations in the northern areas of the subbasin, and total approximately 21 percent of land use. The majority of the irrigated land (gravity flow and sprinkler) is located in the southern portion of the watershed where soils and topography are more amenable to crop production.

A rich riparian community exists around Mud Lake; this is the smallest portion of land use at 1 percent (IDEQ 2005).

The majority (61 percent) of landownership in the Beaver-Camas subbasin is public. The Caribou-Targhee Forest Service manages the high elevation mountainous regions, constituting 28 percent of the subbasin. North of Dubois is a low-gradient basalt plain managed by the United States Department of Agriculture (USDA) Sheep Experiment Station. Outside of the USFS property, the rest of the subbasin is a mosaic of private, BLM, and State ownership. The USFWS owns and manages 2 percent of the land in the subbasin as Camas National Wildlife Refuge (IDEQ 2005).

The Mud Lake Wildlife Management Area (WMA), managed by the Idaho Department of Fish and Game, was established to preserve and improve nesting habitat for waterfowl (IDFG 2010). The first acquisition for the WMA was in 1940, when IDFG purchased 607 acres of Mud Lake wetlands. The latest acquisition was made in 1969. A total of 5,889 acres have been purchased by the State of Idaho for the WMA, the majority (97 percent) with Federal Pittman-Robertson (PR) funds. Currently, a total of 8,853 acres are managed as Mud Lake WMA. This includes 259 acres of land that are leased from the Idaho Department of Lands, and 2,705 acres of U.S. Government withdrawn land (the North Lake Wildlife Management Area) that is administered by the IDFG as part of the Mud Lake WMA (IDFG 1999).

The North Lake State Migratory Waterfowl Refuge (later known as the North Lake Wildlife Management Area) was created by Public Land Order 278 (10 FR 6313, May 21, 1945) which withdrew 313 acres of Federal lands. On October 1, 1954 an additional 2,392 acres were withdrawn under Public Land Order 1014 for a total of 2,705 acres. Both PLOs stated that:

> *Subject to valid existing rights, and to the provisions of existing withdrawals, the following—described public lands in Idaho are hereby withdrawn from all forms of appropriation under public-land laws, and reserved under the jurisdiction of the Department of the Interior for use of the Department of Fish and Game of the State of Idaho, in connection with the North Lake State Migratory Waterfowl Refuge, under such conditions as may be prescribed by the Secretary of the Interior.*

Under the National Wildlife System Improvement Act, a Wildlife Coordination Area is defined as:

> *a wildlife management area that has been previously acquired by the Federal Government and subsequently made available to a State—*
>
> *(A) by cooperative agreement between the United States Fish and Wildlife Service and the State; or*
>
> *(B) is acquired by the Federal Government and subsequently made available to a State—*
>
> *(i) by cooperative agreement between the United States Fish and Wildlife Service and the State fish and game agency pursuant to the Fish and Wildlife Coordination Act (16 U.S.C. 661-666c); or*

(ii) by long-term leases or agreements pursuant to the Bankhead-Jones Farm Tenant Act (50 Stat. 525; 7 U.S.C. 1010 et seq.).

The Act also notes that Coordination Areas are specifically excluded from the definition of the term "refuge." As such, they are exempt from the requirement to develop Comprehensive Conservation Plans and other requirements of the Improvement Act.

1.7.2 Regional Conservation Plans

A brief summary of the major regional conservation plans we considered in the development of the CCP follows:

Idaho Comprehensive Wildlife Conservation Strategy. In 2001, the U.S. Congress began to appropriate Federal funds through the State Wildlife Grants program (SWG) to help meet the need for conservation of all fish and wildlife. Along with this new funding came the responsibility of each state to develop a Comprehensive Wildlife Conservation Strategy (CWCS). Idaho has embraced this program by developing a comprehensive strategy that will serve to coordinate the efforts of all partners working toward conservation of wildlife and wildlife habitats across the State. The Idaho Department of Fish and Game (IDFG) coordinated this effort in compliance with its legal mandate to protect and manage all of the State's fish and wildlife resources.

The aim of Idaho's CWCS is to provide a common framework that will enable conservation partners to jointly implement a long-term approach for the benefit of Species of Greatest Conservation Need (SGCN) (IDFG 2005). To this end, this strategy promotes proactive conservation to ensure cost-effective solutions instead of reactive measures enacted in the face of imminent losses.

Specifically, the Idaho CWCS:

1. Identifies 229 SGCN (103 invertebrates, 126 vertebrates) and associated habitats;
2. Provides an ecological, habitat-based framework to aid in the conservation and management of SGCN;
3. Recommends actions to improve the population status and habitat conditions of SGCN;
4. Describes an approach for long-term monitoring to assess the success of conservation efforts and to integrate new information as it becomes available;
5. Complements other conservation strategies, funding sources, planning initiatives, and legally mandated activities;
6. Incorporates public participation throughout development and implementation to provide an opportunity for all conservation partners and Idaho residents to influence the future of resource management;
7. Provides guidance for use of SWG funds and fulfills Federal requirements associated with these funds; and
8. Provides a clear process for reviewing and revising the Strategy to address changing conditions.

An objective, rule-based process was used to evaluate all animals thought by experts to be a candidate for SGCN. This process was designed specifically to reduce subjectivity and to obtain an objective State rank for species considered for inclusion as SGCN. Factors included, but were not limited to, information about population size, trend, viability, environmental specificity, threats, and protection status. A total of 229 animals (103 invertebrates, 126 vertebrates) were identified as

SGCN. Of these, 64 species (44 invertebrates, 20 vertebrates) lacked essential information pertaining to their status (i.e., S Rank) in Idaho. Therefore, their primary conservation need is more basic population information. For the remaining 165 species (60 invertebrates, 105 vertebrates) there is enough information to determine their status in the State, identify conservation issues, and recommend conservation actions.

Camas NWR is within the Snake River Basalts Section of the Idaho Comprehensive Wildlife Conservation Strategy (ICWCS). Eighty-eight Species of Greatest Conservation Need (SGCN) were identified in the Snake River Basalts Section of the Idaho CWCS. An additional 15 CWCS species with State rankings of S1 (Critically Imperiled), S2 (Imperiled), or S3 (Vulnerable) are known to inhabit Camas NWR, but were not identified as SGCN for the Snake River Basalts Section.

Conservation Plan for the Greater Sage-grouse in Idaho. The 2006 Plan was designed to provide guidance, tools, and resources to Local Working Groups (LWG) to facilitate the development of their plans, while also encouraging a level of statewide consistency among the LWG plans. The primary goal of the Plan is to: Maintain, improve, and where possible, increase sage-grouse populations and habitats in Idaho, while considering the predictability and long-term sustainability of a variety of other land uses (Idaho Sage-grouse Advisory Committee 2006).

Under the framework outlined in this Plan, the LWG plans will identify and prioritize local threats, and identify appropriate conservation measures at the mid- and fine-scale, while this State Plan identifies and prioritizes threats at the broad scale. This Plan also provides a toolbox of fine-scale conservation measures for use and/or adaptation by LWGs (as appropriate to local population and habitat conditions), and for use in cases where a LWG plan has not been completed, or where no LWG currently exists.

Camas NWR is within the Upper Snake LWG. The Upper Snake LWG plan was completed in June of 2009. The goal of the Upper Snake Sage-grouse LWG is to increase sage-grouse populations and/or improve sage-grouse habitat to achieve management objectives in the 2006 Conservation Plan for the Greater Sage-grouse in Idaho. The Local Working Group will attempt to achieve this goal through implementation of recommended habitat, population, partnership, cultural/human, and information based actions.

Habitat based recommended actions within the Upper Snake LWG plan include: habitat inventories; habitat condition evaluations; management for sustainable grass communities; wildfire and prescribed fire policy; habitat recovery and restoration; wetland and riparian management; grazing management; and noxious weed control. Population based recommendations include: sage-grouse population inventories and monitoring; sage-grouse hunting management; and predation management. Partnership recommendations encompass: Enhancement of interagency and interdisciplinary technical assistance; collection of baseline information; conservation project partnerships; identifying funding sources. Cultural/Human recommended actions address: pesticide management; controlling lek access; land use; travel management; and utility corridors. Information actions entail: development of Internet home page; and creating an information repository.

Idaho Mule Deer Management Plan 2008-2017. The Mule Deer Management Plan tiers off of the Idaho Department of Fish and Game (IDFG) strategic plan, functioning as the action plan for mule deer management in the State (IDFG 2008). Major issues affecting mule deer management are identified, setting overall direction for mule deer management during the next 10 years and providing performance targets and management strategies for management actions.

Camas NWR within the Snake River Population Management Unit (PMU) and includes Game Management Units 38, 52A, 53, 63, 63A, 68, 68A. The Snake River PMU has multiple habitat and population based management direction, performance targets, and strategies. Relevant management direction identified in the plan for incorporation into the Camas NWR CCP includes habitat improvements to key winter, summer, and transitional mule deer habitats.

Idaho Elk Management Plan 1999. The Elk Management Plan tiers off of the Idaho Department of Fish and Game (IDFG) strategic plan, functioning as the action plan for elk management in the State. Management objectives, historical perspectives, and issues associated with habitat, biology, inter-specific competition, predation, and winter feeding are addressed in this plan for 28 of the 29 elk management zones. Only the Snake River Zone (Game Management Units 53, 63, 63A, 68A), which encompasses both Camas and Minidoka NWRs, remained unaddressed in the plan. Idaho's revised elk management plan, which will guide elk management for the next 10 years, was released for public comment in August 2013. The draft plan included includes management direction for all zones, including the Snake River Zone. The final plan will be submitted to the Idaho Fish and Game Commission for approval in January 2014 (IDFG 2013a).

Camas NWR lies within Game Management Unit (GMU) 63. In 2013, GMU 63 was managed for a general elk season allowing only A-tag hunts in GMU 63. The general A-tag hunt for GMU 63 in 2013 was an any-weapon, any-elk hunt from August 1 through August 31 and an any-weapon antlerless only hunt September 1 through December 31. No controlled hunts for elk were offered in 2013 for GMU 63 (IDFG 2013b). Depredation hunts may also be offered on limited basis at the discretion of the Idaho Fish and Game Department.

Birds of Conservation Concern 2008. The 1988 amendment to the Fish and Wildlife Conservation Act mandates the U.S. Fish and Wildlife Service (USFWS) to "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the Endangered Species Act (ESA) of 1973." *Birds of Conservation Concern 2008* (*BCC 2008*) is the most recent effort to carry out this mandate. The overall goal of this report is to accurately identify the migratory and non-migratory bird species (beyond those already designated as federally threatened or endangered) that represent our highest conservation priorities (USFWS 2008a). The geographic scope of this endeavor is the United States in its entirety, including island territories in the Pacific and Caribbean. *BCC 2008* encompasses three distinct geographic scales—North American Bird Conservation Initiative (NABCI) Bird Conservation Regions (BCRs), USFWS Regions, and National—and is primarily derived from assessment scores from three major bird conservation plans: the Partners in Flight North American Landbird Conservation Plan, the United States Shorebird Conservation Plan, and the North American Waterbird Conservation Plan.

The Camas NWR is a part of USFWS Region 1 (Pacific Region), which includes the mainland states of Washington, Oregon, and Idaho. The Refuge is within BCR 9 (Great Basin), but also borders BCR 10 (Northern Rockies). Of the 34 mainland species identified in the Region 1 BCC list, 20 have been documented at Camas NWR. Additionally, 15 of the 28 Birds of Conservation Concern from BCR 9-Great Basin, and 15 of the 22 from BCR 10-Northern Rockies, occur at the Refuge.

U.S. Shorebird Conservation Plan. Few direct specific habitat guidelines are provided by the U.S. Shorebird Conservation Plan, which instead, seeks to identify key shorebird regions throughout the continent, and allow regional committees to determine the best locations for shorebird restoration initiatives to be conducted (Brown et al. 2001). Camas NWR is within the Intermountain West

Region, stretching from Canada to Mexico and from the Rocky Mountains to the Sierras and Cascades.

Intermountain West Regional Shorebird Plan. The Intermountain West Regional Shorebird Plan maintains a series of habitat restoration objectives centered around delineating regionally important sites, and incorporating restoration activities into a landscape scale design (Oring et al. 2005). The Intermountain West Region is composed of six Bird Conservation Regions (BCRs), represented by an array of habitats from saline sinks to alpine streams. The plan identifies 11 species of shorebirds as regular breeders in the Intermountain West (IMW), and 23 additional species are annual migrants. The plan identified human competition for and consumption of water as the most important issue facing the IMW. The IMW plan addresses this and other issues through five goals and associated objectives and strategies for habitat management, monitoring and assessments, research, outreach, and planning. Camas NWR is within the Great Basin BCR, which includes the interior drainage systems of Nevada, western Utah, eastern California, southeastern Oregon, and southern Idaho.

The plan did not identify Camas NWR as an important Great Basin BCR wetland, but did identify Grays Lake, for breeding sandhill cranes, and Bear Lake NWR, for breeding white-faced ibis and Franklin's gulls as important. Snowy plover, long-billed curlew, American avocet, and black-necked stilt were identified as important for breeding shorebirds in the Great Basin BCR. Five other species were identified to occur as substantial breeders in the Great Basin, including: killdeer; willet; spotted sandpiper; Wilson's phalarope, and common snipe. Upland sandpipers were noted to breed outside the Great basin hydrological area, but within the Great Basin BCR. While no species were identified as important Great Basin wintering species, Wilson's phalarope, red-necked phalarope, American avocet, long-billed dowitcher, marbled godwit, western sandpiper, and least sandpiper were listed as important stopover species.

North American Waterbird Conservation Plan. The ultimate goal of the plan is "To protect, restore, and manage sufficient high quality habitat and key sites for waterbirds throughout the year to meet species and population goals" (Kushlan et al. 2002). Focusing primarily on colonial nesting waterbirds, the plan seeks to develop cross-cultural partnerships to encompass waterbird habitat across the Americas.

Camas NWR serves as a nesting site for several nesting waterbird species prioritized in the North American Waterbird Conservation Plan. One low and three moderate North American Waterbird Conservation Plan conservation concern species occur at Camas NWR with breeding and wintering distributions that occur only in North America. Two waterbirds which breed in the Western Hemisphere (North and South America) are represented at Camas (one moderate, and one low species of conservation concern). The plan also identifies three moderate and one low species of conservation concern which occur on the Refuge as "Cosmopolitan distribution breeding and wintering species."

Intermountain West Waterbird Conservation Plan. This Intermountain West Waterbird Conservation Plan (IWWCP) is one of several regional step-down plans designed to implement the North American Waterbird Conservation Plan. As defined by these hierarchical plans, waterbirds are wetland-dependent species including both colonial breeders (e.g., gulls, terns, most grebes, cormorants, herons, egrets, ibis and pelicans), and solitary nesting marshbirds (e.g., cranes, rails, coots, bitterns and loons). Shorebirds and waterfowl are covered by other bird conservation initiatives and, thus, were excluded from this plan. The goal of the IWWCP is to maintain healthy populations, distributions, and habitats of waterbirds throughout the Intermountain West region (Ivey and Herziger 2006). The regional planning area of the IWWCP includes the U.S. portions of 11 western states and four Bird Conservation Regions that are defined as geographic regions with similar habitat conditions delineated to facilitate bird conservation efforts.

The IWWCP listed general habitat conservation objectives and targets restoration areas should consider:

1. Areas rich in priority birds and habitats
2. Opportunities for conservation and partnerships
3. Threats to priority species and habitats
4. Areas large enough in scale to achieve meaningful conservation and small enough to capture local working groups.

Camas NWR has documented the occurrence of seven high and three moderate priority IWWCP species for BCR 9 (Great Basin). The Refuge contains colonial waterbird breeding habitat for one (Franklin's gull) of two high concern colonial BCR 9 species. The IWWCP identified Camas NWR as one of 44 notable waterbird sites within the Intermountain West. The plan summarized refuge challenges associated with the cost of pumping groundwater to sufficiently fill refuge wetlands due to the lowering of the groundwater table and lessening of Camas Creek in-stream flows from agricultural irrigation. The IWWCP further noted that Camas NWR and Market and Mud Lake WMAs hosted a historic breeding population of approximately 3,500 Franklin's gulls, but that the recent breeding population was diminished due to drought.

The plan specifically called for a conservation action for the maintenance of suitable emergent breeding habitats for nesting sites to support at least 2,670 white-faced ibis nests collectively at Market and Mud Lake WMAs, Camas NWR, Oxford Slough WPA, and the Duck Valley Indian Reservation. General conservation strategies for species within the Idaho portion of BCR 9 (Great Basin) included:

- Sandhill Crane (RMP): Conserve, restore, and protect wet meadow/seasonal marsh breeding habitat.
- California Gull: Implement conservation to maintain existing breeding sites.
- Franklin's Gull: Implement conservation to maintain existing breeding sites.
- Forster's Tern: No net loss of existing nesting habitat at known breeding sites to support at least 40 pairs.
- Black Tern: Maintain emergent wetland habitat at known breeding sites to support at least 60 pairs.
- Pied-billed Grebe: No net loss of existing seasonal or semi-permanent wetlands.
- Great Blue Heron: Maintain suitable riparian nesting areas to maintain at least 900 pairs.
- Black-crowned Night Heron: Maintain suitable emergent wetland breeding habitats to support at least 770 nests.
- American Bittern: No net loss of existing seasonal or semi-permanent wetland habitats. Maintain freshwater wetlands > 10 ha (2.5 acre).

North American Waterfowl Management Plan. This plan was adopted by the United States and Canada in 1986, and by Mexico in 1994, to address the conservation and restoration of waterfowl, other migratory waterbirds, and the habitats on which they depend. The Plan, as adopted, aims to restore waterfowl populations to 1970-1979 levels and establishes specific population objectives for 25 species of ducks, five species of geese, plus trumpeter and tundra swans. The Plan was updated in 1998 and 2003. The NAWMP states that the goal is "to return waterfowl populations to their 1970s levels by conserving wetland and upland habitat" (North American Waterfowl Management Plan Committee 2004). This will be accomplished through a combination of a solid "Biological Foundation, Landscape Approach, and Partnerships."

Camas NWR lies between two National priority sites: Priority Area 28, Yellowstone-Intermountain Wetlands, and Priority Area 27, Great Salt Lake and Bear River Marshes. The Refuge maintains a nexus with each Priority Area through provision of quality breeding and migration habitat for waterfowl and the provision of quality breeding habitat for trumpeter swans and overwater nesting waterfowl species such as redhead and canvasback. National breeding population objectives for key waterfowl species include the northern pintail (5.6 million, decreasing), mallard (8.2 million, no trend), and greater and lesser scaup (6.3 million, decreasing) among which only the mallard population has satisfied this objective (8.64 million). Current refuge populations for these species are relatively small compared to these National Objectives; however, they are regionally significant considering proximity to NAWMP high profile sites. The plan also lists breeding population objectives for redhead (640,000) and canvasback (540,000), both of which are currently above the population objective on a National basis, but with insufficient data to estimate trend information. The remaining three plan-listed priority species—wood duck (200,000 western population), American wigeon (3.1 million total population), and ring-necked duck (2 million)—are all considered to be either increasing or to have stable populations.

IWJV Habitat Conservation Objectives: The IWJV lists the following habitat objectives in their 1995 implementation plan.

1. To protect 1.5 million public and private acres through facilitation of conservation easements, management agreements, incentive programs, and stewardship programs.
2. To restore and enhance 1 million acres of wetland habitat through direct habitat improvement programs
3. To enhance all bird habitat through direct habitat improvement programs, public education, and cooperation with our partners.

More recently, the IWJV has developed a coordinated implementation plan to consolidate region specific information from each of the four National Plans. The 2005 update to the IWJV Coordinated Bird Conservation Implementation Plan describes goals and objectives for two priority habitat types, which occur at Camas NWR.

IWJV Coordinated Implementation Plan for Bird Habitat in Idaho (IWJVCIP). Prepared for the Intermountain West Joint Venture, the coordinated implementation plan seeks to address and consolidate National Plan habitat objectives into one document (Idaho Steering Committee—Intermountain West Joint Venture 2005). The IWJV Management Board decided in 2007 to update the 2005 Implementation Plan to include model-driven habitat objectives and spatially explicit decision-support tools. This update was slated for completion in 2010. The 2010 plan will embody the principles of Strategic Habitat Conservation and be responsive to the 2007 NAWMP Continental Assessment. The 2010 plans intent is to extend the existing strong science foundation consistent with the objectives of all four major bird initiatives and the 11 State Wildlife Action Plans. The new plan will strive to meet the *Desired Characteristics for Joint Venture Implementation Plans*, which was recently adopted by the NAWMP Plan Committee and will address emerging issues such as climate change.

The current 2005 IWJVCIP plan for Idaho places Camas NWR a part of the Medicine Lodge Conservation Area, one of 23 priority Conservation Areas in Idaho. Camas NWR contains three of the four most critical Priority A habitat types—wetlands (marshes, lakes, and ponds), riparian, and sagebrush—within the Medicine Lodge Conservation Area. The Refuge additionally contains two of the six Priority B habitats (agriculture and grassland) within the Medicine Lodge CA.

Southeast Idaho Wetland Focus Area, Wetland Conservation Plan (IWJV). This plan lists the mallard and northern pintail as priority species. According to the plan, mallards are the most abundant duck species in Southeast Idaho, while northern pintail breeding populations continue to decline. Other important waterbird groups include colonial nesting waterbirds, of which five species are recognized as National species of low or moderate concern (American white pelican, California gull, white-faced ibis, western grebe, and Clark's grebe). Plan authors used a habitat based, as opposed to population objective approach, and described the desired future condition needed to support these species: *"wetlands should be protected/maintained/enhanced/restored in such condition that the hydrology of a site remains intact."*

Concept Plan for Preservation of Redhead Breeding Habitat in Idaho. In response to declining population numbers, the U.S. Fish and Wildlife Service conducted an evaluation to document the extent of redhead breeding habitat in the Great Basin and formulate a strategy to maximize habitat restoration efforts. The plan looked at wetlands within Idaho for their importance to redhead production based on a complex set of ranking factors. Primary among these factors were the contributions of perennial emergent marsh for redheads, the importance of these habitats for other waterfowl species, and the increasing threat of agricultural water distribution during the breeding season.

Conservation Strategy for Southeast Idaho Wetlands. Through funding provided by the Environmental Protection Agency (EPA), the Idaho Department of Fish and Game conducted a study to characterize and rank wetland importance in southeast Idaho. The study area only extended to the South Fork of the Snake River, therefore excluding Camas NWR. However, this initiative classified several waterbird species of importance for consideration in wetland management, 15 of which occur at Camas NWR.

Audubon Society Important Bird Area. Camas NWR has been designated as an Important Bird Area by the National Audubon Society. Idaho's Important Bird Areas (IBA) Program was launched in 1996 as a partnership between Idaho Partners in Flight and the Idaho Audubon Council. Since 1997, the IBA Technical Committee has encouraged and reviewed nominations for potential IBAs. To date, 55 sites have been officially recognized as Important Bird Areas in Idaho, representing 3.8 million acres of public and private wetland and upland habitat throughout the State. The monitoring phase of the Idaho IBA program is underway, with monitoring at several IBAs being conducted either by biologists responsible for the management of the area, or by volunteers. These monitoring efforts, which are intended to collect basic information about the IBAs, will create an inventory of bird species present at each site, at a minimum, and will likely lead to further investigations.

The Columbia Plateau Ecoregional Assessment. The Nature Conservancy (TNC) has adopted ecoregion-based planning as the most effective way to achieve its national mission of preserving a diversity of plants, animals, and natural communities. The planning process used by TNC follows a methodology outlined in their publication *Geography of Hope* (2000) that defines a vision of conservation success at an ecoregional scale, and is based on documenting and mapping a list or "portfolio" of biologically outstanding sites that represent a full complement of ecosystems, natural communities, and species characteristics of the ecoregion. This methodology may be used to direct TNC programs and influence other conservation efforts across the United States. The ecoregional plans are based on amended ecoregional units delineated by Bailey et al. (1998).

These ecoregional boundaries approximate but do not necessarily match the BCR boundaries. For example, Idaho Falls is within five of TNC's ecoregions. The Columbia Plateau Ecoregion covers most of southern Idaho, as well as the west-central panhandle. The Middle Rocky Mountain-Blue Mountain Ecoregion covers most of central Idaho, and the Canadian Rockies Ecoregion covers the remainder of the Idaho Panhandle. The Utah-Wyoming Rocky Mountains Ecoregion includes the eastern edge of the State, abutting Wyoming, and a small sliver of the Utah High Plateaus Ecoregion juts into the very southwestern corner of the State. TNC is developing ecoregional assessments and plans for all of the ecoregions, which cover Idaho. Timing of the completion of these plans will vary, depending on TNC priorities and which State office of TNC is taking lead responsibility for each plan.

Camas NWR and Mud Lake WMA were identified as one of 104 Conservation Portfolio Sites within the Columbia Plateau Ecoregion. Although TNC's ecoregional plans are not specifically designed as bird conservation plans, they do include the identification and classification of those habitat types, areas, and sites, which provide important habitat for birds. Birds identified as conservation targets for the five ecoregions are linked to the portfolio sites in those ecoregional plans. Target Bird Species, listed by TNC for each ecological system group, were obtained from the literature and interviews with acknowledged experts.

1.7.3 Pacific Flyway Management Plans

The Pacific Flyway Council is an administrative body that forges cooperation among public wildlife agencies for the purpose of protecting and conserving migratory game birds in western North America. The Council has prepared numerous management plans to date for most populations of swans, geese, and sandhill cranes in the Pacific Flyway (www.pacificflyway.gov). These plans typically focus on populations, which are the primary unit of management, but may be specific to a species or subspecies. Management plans serve to:

- Identify common goals;
- Coordinate collection and analysis of biological data;
- Establish the priority of management actions and responsibility for them; and
- Emphasize research needed to improve management.

The Council creates flyway management plans to help state and Federal agencies cooperatively manage migratory game birds under common goals. Management strategies are recommendations, but do not commit agencies to specific actions or schedules. Fiscal, legislative, and priority constraints influence the level and timing of implementation. Pacific Flyway plans generally guide management and research for a five-year planning horizon. Several of these plans pertain to species found on the Refuge. A brief summary of the flyway management plans we considered in the development of this CCP follows.

Management Plan of the Pacific and Central Flyways for the Rocky Mountain Population of Greater Sandhill Cranes (2007)

This plan is a revision of the July 1997 Rocky Mountain Population (RMP) sandhill crane plan. Its purpose is to establish guidelines for managing RMP sandhill cranes. The plan addresses habitats (breeding range, fall staging areas, migration routes, fall and spring stopover areas, and winter areas), status, uses, current management, problems associated with the population, and crane hunting guidelines.

The primary objective of the plan is to manage the RMP for numbers and distribution that will provide maximum direct benefit to the public and for the intrinsic values of the birds themselves. Objectives include: A) Manage for a stable population index of 17,000-21,000 cranes determined by an average of the 3 most recent reliable September (fall pre-migration) surveys; B) Maintain and protect suitable habitats in sufficient quantity and quality to support population objectives and spatial distribution, while encouraging populations expansion where desirable; C) Provide for recreational uses of RMP cranes; and D) Minimize crop depredations by RMP cranes (Subcommittee on Rocky Mountain Greater Sandhill Cranes 2007).

The plan recommends several management procedures. The degree and timing of their implementation by the various lead agencies will be influenced by manpower and fiscal and legislative constraints beyond the scope of the plan. The following procedures within the plan are the most pertinent to CCP development for the four refuges of the Southeast Idaho Complex:

1. The IDFG, in cooperation with other State and Federal agencies, nongovernmental organizations, and private parties, will work to annually provide 600-1,000 acres of supplemental feed crops in strategic locations to help alleviate crop damage. Funding for this program will come primarily from the interest earned by a Lure Crop Endowment established from private contributions.
2. Encourage to identify, classify, rank, and catalog habitats used by the RMP throughout its range to facilitate the protection of important habitat through acquisition, easement, cooperative agreements, special use permits, and mitigation exchanges and developments.
3. Promoting increased awareness and understanding of cranes was deemed essential to the well-being of the RMP cranes. Individual state wildlife agencies and the FWS will cooperatively develop and distribute information on the life history of RMP cranes and important management issues.
4. The plan calls on the Subcommittees to consider problem situations and recommend options to the appropriate state agencies for reducing or eliminating crop damage. Various individuals, nongovernmental organizations, and other agencies will be encouraged to suggest solutions.
5. Population surveys are to be done each September when peak numbers of cranes are present on pre-migration staging areas in summer range states.
6. As appropriate, the Subcommittees will develop research proposals, recommend needed research, and review research proposals. In these actions, the Subcommittees will give priority to research conducted on the RMP or regional flocks/subpopulations, rather than local projects.

Pacific Flyway Management Plan for the Rocky Mountain Population of Western Canada Geese (2000)

The purpose of this plan is to improve coordinated management of western Canada geese by providing goals and objectives to guide wildlife agencies responsible for management programs for a five-year period.

The western Canada goose (*Branta canadensis moffitti*) occurring within the Pacific Flyway is currently recognized for management purposes as consisting of two populations: the Pacific Population (PP) and the Rocky Mountain Population (RMP) (Krohn and Bizeau 1980). The RMP population is primarily migratory with geese undertaking spring and fall migrations between breeding and wintering areas. Due to interstate and international distribution of certain flocks and shared management concerns, management of this resource requires interstate and international coordination.

Sixteen reference areas are used in this plan to facilitate management and tabulation of population and harvest data. These areas were delineated on the basis of band recovery distribution and are defined in detail by Krohn and Bizeau (1980). The four NWRs of the Southeast Idaho NWR Complex fall within Southeast Idaho Reference Area 3.

The goal of this management plan is to maintain numbers and distribution of RMP Canada geese to optimize recreational opportunity while controlling depredation and nuisance problems.

Objectives of this plan are to:

1. Maintain a breeding population index of 117,000 birds, while considering desired levels of regional breeding and wintering flocks within individual reference areas. For Reference Area 3 (Southeastern Idaho) there is a Breeding Population Index of 5,040 and an Objective Breeding Population Index of 5,550;
2. Maintain seasonal breeding, wintering, and molting distributions;
3. Maintain suitable breeding and wintering habitats to support distribution objectives;
4. Maintain optimum hunting opportunities and provide for viewing, educational, and scientific pursuits;
5. Evaluate current population and reference area boundaries to determine if they reflect true demographic differences among neighboring Canada goose populations (PP, Hi-Line Population (HLP), and RMP); and
6. Evaluate depredation and nuisance issues and implement management practices where appropriate.

The plan recommends several management procedures. The degree and timing of their implementation by the various lead agencies will be influenced by manpower and fiscal and legislative constraints beyond the scope of the plan. The following procedures within the plan are the most pertinent to CCP development for the four refuges within the Southeast Idaho Complex:

1. Annual Breeding Population Index: Breeding population surveys will be conducted within each reference area throughout the breeding range of RMP Canada geese. These surveys may be either breeding pair or breeding population surveys.

2. Banding Needs Assessment: Banding for monitoring recovery distribution, derivation of harvest, harvest, and survival rates for individual flocks, will be considered as part of a needs assessment.
3. Annual Production Trend Survey: Nesting and/or brood surveys are encouraged in all reference areas throughout the breeding range of RMP Canada geese.
4. Annual Midwinter Waterfowl Survey: RMP Canada geese will be counted in all reference areas that support concentrations of wintering geese during the MWS, which is normally conducted during the first week in January.
5. Research: The Subcommittee will, as needed, recommend research and review proposals for research. The Subcommittee will establish priorities for research based on the needs of the RMP. Areas of identifiable needed research include Harvest Information and Range Delineation.
6. Depredation and Nuisance Problems: Increasing problems with depredation and nuisance Canada geese facilitated the development of a Flyway Depredation Policy. The plan asks all agencies to implement programs to assist in the deployment of management actions to assist landowners.

Pacific Flyway Management Plan for the Rocky Mountain Population of Trumpeter Swans (2008)

The goal of this management plan is to restore the RMP as a secure and primarily migratory population, sustained by naturally occurring and agricultural food resources in diverse breeding and wintering sites (Subcommittee on Rocky Mountain Trumpeter Swans 2008). Management objectives are:

1. Continue to encourage swans to use wintering areas outside of the core Tri-State Area while reducing the number of wintering swans in the core Tri-State Area to a maximum of 1,500;
2. Rebuild U.S. nesting flocks by year 2013 to at least 165 nesting pairs (birds that display evidence of nesting) and 718 adults and subadults (white birds) that use natural, diverse habitats. For Idaho, the plan identifies a target of 30 nesting pairs and 175 adults and sub-adults, by 2013. Furthermore, the plan calls for specific nesting and adult/sub-adult objectives for: Grays Lake NWR (10 and 30 respectively); Bear Lake NWR (5 and 25 respectively); and Camas County (1 and 5 respectively).
3. Expand the breeding range in order to enhance the connectivity of breeding flocks;
4. Increase the abundance of desirable submerged macrophytes (aquatic plants) in the Henrys Fork of the Snake River in and near Harriman State Park.
5. Promote the restoration and development of high quality wetland habitats for breeding and wintering swans; and
6. Monitor the population.

Important management strategies to achieve the objectives include:

1. Reduce the attractiveness of HSP [Harriman State Park] by manipulating water levels;
2. Provide habitat to attain population objectives;
3. Identify potential breeding and winter expansion areas; 4) evaluate the effectiveness of raising cygnets from eggs collected in Canada to increase the availability of swans for release and to increase genetic heterozygosity;
4. Identify, fund, and implement new wetland projects;

5. Translocate flightless U.S. and Canadian cygnets as appropriate;
6. Continue to monitor submerged macrophytes in the Henrys Fork of the Snake River;
7. Develop and implement an effective public information program; and
8. Maintain trumpeter swan–compatible, tundra swan sport hunting opportunities in the Pacific Flyway.

Pacific Flyway Management Plan for the Western Population (WP) of Tundra Swans (2001)

The goal of the tundra swan plan is to ensure the maintenance of the western population (WP) of tundra swans, at a size and distribution that will provide for all their benefits to society (Pacific Flyway Council 2001).

Objectives of this plan are to:

1. Maintain a population of at least 60,000 swans to provide suitable public benefits;
2. Maintain current patterns of distribution throughout the WP tundra swan range;
3. Provide breeding, migration, and wintering habitats of sufficient quantity and quality to maintain the desired numbers and distribution of swans;
4. Provide for aesthetic, educational, and scientific uses of swans; and
5. Provide for sustainable sport and subsistence harvests of WP swans.

Surveillance for Early Detection of Highly Pathogenic Avian Influenza H5N1 in Wild Migratory Birds (2006)

The overall goal for this strategy is to provide guidance to Pacific Flyway wildlife agencies in planning and implementing surveillance to detect Asian H5N1 in wild migratory birds. The plan was intended as a step-down approach from the draft U.S. Interagency Strategic Plan (Interagency HPAI Early Detection Working Group 2006) to articulate flyway-level objectives, recommend surveillance strategies, and support further planning in each state to assess available and needed agency resources.

The goal of the national strategy and this Pacific Flyway strategy is early detection of Asian H5N1 in wild migratory birds—not to assess its prevalence over time, monitor its rate of movement, or investigate the ecology of the disease.

This strategy did not intend to provide detailed implementation plans for each Pacific Flyway state. The strategy also does not dictate rigid sampling objectives—the intent is to provide a sense of priorities, but not to constrain sampling of species or areas deemed important by the states or other cooperators. Surveillance efforts for Asian H5N1 will involve, by necessity, extensive cooperation at state and local levels among wildlife agencies, agriculture agencies, public health systems, and other entities—efforts best left to adaptive approaches by our member agencies. Thus, the scope of this strategy is focused on a flyway-level framework for surveillance of wild migratory waterbird populations that are shared and cooperatively managed throughout the Pacific Flyway.

Objectives of the plan include:

1. Prioritize waterbird species to be sampled for Asian H5N1 in the Pacific Flyway.
2. Recommend a suite of sampling approaches to effectively establish an Asian H5N1 detection system in wild migratory birds.

3. Provide guidance to states and cooperators to develop state-specific implementation plans.
4. Recommend procedures to integrate detection efforts within the Pacific Flyway and with national programs.
5. Describe additional planning efforts and coordination necessary to establish and maintain an effective Asian H5N1 detection system in the flyway.

1.7.4 Partners in Flight Landbird Conservation Plans

The national Partners in Flight (PIF) program began in 1989 as a coordinated effort to document and reverse apparent declines in the populations of neotropical migratory birds, those birds that breed north of Mexico and then migrate to Mexico, Central and South America, and the Caribbean in the winter months. Their proactive stance is to “keep common birds common.” The National Fish and Wildlife Foundation took the lead in bringing together Federal, state, and local government agencies, foundations, conservation groups, industry and the academic community to address the problem of population declines. The reasons are complex, and include loss of breeding habitat due to fragmentation, alteration, urban expansion and natural disasters; loss or alteration of habitat in non-breeding areas and along migratory routes; and brood parasitism. The PIF program was later expanded to include all nongame land birds.

Today, PIF is an international program, with eastern and western regional coordinators and PIF Working Groups in each state. In 2000, the American Bird Conservancy (ABC) published the first comprehensive national plan for the program, titled *Partners in Flight: Conservation of the Land Birds of the United States*. This planning document summarizes the goals and priorities of the various state Bird Conservation Plans, as well as 93 physiographic areas and seven generalized regions of the continental United States. It also encourages better coordination with other initiatives such as the NAWMP, U.S. Shorebird Management Plan, and the North American Waterbird Conservation Plan. PIF initially divided Idaho into three physiographic areas, but for purposes of coordinated bird conservation, these have now been replaced by the BCRs. Passage of the Neotropical Migratory Bird Conservation Act in 2001 provided a new Federal commitment to the conservation of neotropical migrant species addressed by PIF. In September 2003, PIF released a new North American Landbird Conservation Plan.

Idaho PIF was formed in 1992 to direct resources of PIF partners to the conservation of birds and their habitats through cooperative efforts in the areas of monitoring, research, management and education. Idaho PIF is a public-private partnership made up of professionals from State and Federal natural resource agencies, universities, Native American tribes, private industry and nongovernmental organizations. The Idaho PIF steering committee is made up of a number of partners, including representatives from the Idaho Department of Fish and Game, U.S. Fish and Wildlife Service, USDA Forest Service, Bureau of Land Management, U.S. Geological Survey, Audubon Society, and the Potlatch Corporation.

Idaho Partners in Flight, Idaho Bird Conservation Plan (IBCP): In January 2000, Idaho PIF released Version 1.0 of the Idaho Bird Conservation Plan (BCP), which was based on an assessment of the status of 243 species of breeding birds in Idaho, including waterfowl, shorebirds, waterbirds and 119 species of Neotropical migrants (Ritter 2000). This assessment identified 60 species of Idaho breeding birds, considered to be High Priority species in Idaho. These 60 species are organized into 12 habitats, which are listed in the BCP. These habitats in turn were combined and synthesized into four habitats considered to be the highest priority for Idaho birds: Riparian, Non-riverine wetlands (marshes lakes and ponds), Sagebrush Shrublands (excluding salt desert shrub), and Ponderosa Pine (dry Ponderosa Pine/Douglas Fir/Grand Fir) forests. Each of these four priority habitats is described in the BCP, along with their importance to birds. Also included in the BCP are statewide habitat objectives, issues, strategies and tasks for implementing those habitat objectives. For Idaho, the BCP remains the best statewide summary of species and associated habitat information, and is one of the primary sources of information used in developing a Coordinated Implementation Plan for Bird Conservation in Idaho.

The January 2000 Version 1.0 of the Idaho Partners in Flight BCP identified 62 high priority Idaho species and 68 moderate priority Idaho species. Forty-six of the 62 high priority Idaho species are found on the Refuge. Thirty-five of these 46 high priority refuge species were classified as a high priority species for Physiographic Areas other than the Refuge’s Physiographic Area 89 (Columbia Plateau). Eighteen of these refuge species were ranked a high priority for Idaho-wide distribution, nine were a priority within Physiographic Area 64 (Central Rocky Mountains), and eight refuge species were a priority in Physiographic Area 89 (Columbia Plateau). Only one (Wilson’s phalarope) of the 35 moderate priority Idaho PIF species that occur on the Refuge is classified a priority within Physiographic Area 89. The remaining moderate priority species occur as an Idaho-wide priority (n=24), Physiographic Area 64 priority (n=5) and Physiographic Area 80 priority (n=5).

Since the publication of Version 1.0 of the Idaho BCP, Idaho PIF has revised its list of priority bird species and their respective priority level classifications. The revised list reflects more objective classification rules, updated PIF priority scores, and a BCR-level approach. Species are classified into one of four priority-level categories: (1) Level I (highest priority); (2) Level II (moderate priority); (3) Level III (low priority); and (4) Level IV (no priority). Fifty-eight species were classified as Level I or Level II priority in BCRs 9 (Northern Rockies) and 10 (Great Basin). Ranking criteria included Relative Abundance, Breeding Distribution, Non-breeding Distribution, Breeding Area Importance, Threats to Breeding, Threats to Non-breeding, and Breeding Population Trend. Also included in the ranking process (in part to help make the BCR-level scores more relevant to Idaho), is the relative importance of Idaho to a particular species and its conservation, based upon the abundance of that species in Idaho (Idaho Area Importance). Camas NWR has documented the occurrence of 32 of the 52 PIF regionally important species for Idaho on the Refuge. Of these 32 bird species, none were ranked for management action of Critical Recovery (CR); five for Immediate Action (IM), which include sage-grouse, Lewis’s woodpecker, Brewer’s sparrow, olive-sided flycatcher, and willow flycatcher, 15 for Management Attention (MA), and 12 for Planning and Responsibility (PR) oversight.

1.7.5 Recovery Plans

The Endangered Species Act (ESA) (16 U.S.C. §§ 1531-1544, December 28, 1973, as amended 1976-1982, 1984 and 1988) states in SEC. 8A.(a) that “The Secretary of the Interior … is designated as the Management Authority and the Scientific Authority for purposes of the Convention and the respective functions of each such Authority shall be carried out through the United States Fish and Wildlife Service.” The Act also requires that “all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act.”

No federally listed endangered or threatened species occur within or immediately adjacent to Camas NWR. There are no goals, objectives, strategies, actions, or tasks identified in any regional ESA recovery plans applicable to Camas NWR.

1.8 Issues, Concerns, and Opportunities

1.8.1 Major Issues to be Addressed in the CCP

The core planning team evaluated and presented refuge issues and concerns during public scoping. Issues are defined as matters of controversy, dispute, or general concern over resource management activities, the environment, land uses, or public use activities. Issues are important to the planning process because they identify topics to be addressed in the CCP, pinpoint the types of information to gather, and help define alternatives for the CCP. Additional issues, concerns, and opportunities were raised during the public scoping process; we addressed them all in some manner in the Draft CCP/EA. It is the Service's responsibility to focus planning and the EA 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. Major issues will influence the decisions proposed in the Draft CCP/EA. The following issues, concerns, and opportunities were presented during public scoping and were considered in the Draft CCP/EA.

1. Wetland Management

a. Water Quantity

The Ecological Integrity Assessment for Camas NWR (Kittel et al. 2012) concluded that Camas NWR has some of the best condition low elevation wetlands within the local Beaver-Camas watershed. Camas NWR also has some of the best base-of-the-foothills positioned wetlands in the entire Upper Snake River Watershed, especially along the northern edge of the Snake River Plain. The location of Camas' wetland and riparian areas within a landscape that has largely been converted to intensive production agriculture, as well as its position within an interior arm of the Pacific Flyway, make it strategically important for supporting wildlife movement and long-term conservation of wetland-dependent species. Refuge wetlands are managed to provide high quality habitat in support of nesting and migrating waterbirds. Current management actions consist of manipulating water on an annual basis to produce desirable food and cover plant species, and provide wetland features during appropriate times of the year for resting, foraging, or breeding of wetland-associated species.

Since the 1980s, the water table in the Camas NWR area has dropped approximately 15 feet (see Chapter 3). The causes include: a 10+ year drought cycle; cessation of irrigation on the Egin Bench in the 1980s; local water demands for agriculture; and the incising of Camas Creek, which exacerbates the effects of a lower water table. Historically Camas Creek overflowed its banks each spring, creating seasonal and temporary wetlands. In the early 1900s, subirrigation on the Egin Bench, 15 miles to the east, caused artesian flow in the Camas/Mud Lake area to increase, creating permanent and semipermanent wetlands. Under this hydrologic regime, which was present at the time of refuge establishment, wetlands retained water for most of the year.

Since the duration of Camas Creek spring flows is reduced compared to historic conditions and the local water table has dropped, many of the once-artesian wells have been replaced by mechanical pumps. Now seven irrigation wells are used to supplement the spring runoff; they are run from mid-March to October but still cannot keep many of the Refuge's wetlands hydrated for the length of time needed for brood rearing to be completed. When the pumps are turned off, most of the water slowly sinks back into the water table. This leaves many refuge wetlands dry by late fall through the winter.

At this time, more than 25 percent of Refuge wetlands have been placed in "inactive" status, and several other large wetlands are dry for much of the year. The current management strategy will not continue to meet our management goals due to water and budget limitations.

i. Open and Deep Water Habitat: In recent years, some open water and deep emergent wetland basins at Camas NWR have experienced drier conditions and subsequent heavy encroachment from a variety of more mesic upland meadow species. If groundwater pumping were to cease, many of the deep water permanently or semi-permanently flooded wetland basins would revert to seasonally or temporarily flooded wet meadows, or possibly dry meadows. If this habitat succession were to occur, it would likely diminish use by waterfowl and shorebirds, but benefit guilds more associated with those habitat types such as migratory landbirds, rails, and soras.

ii. Wet Meadow Habitat: Wet meadows are among the rarest plant communities in the region and provide a diverse realm of wildlife habitat. Wet meadows consist of native grasses and forbs with almost no trees or shrubs. As previously noted, some seasonal wetland communities may naturally move toward wet meadow plant species and may need to be managed as such, but it is unknown how many acres of habitat is necessary to be of benefit to guilds such as migratory songbirds.

b. Water Quality

As a refuge partially surrounded by agricultural lands, there are external threats that may be impacting water quality and quantity to refuge wetlands and streams within the surrounding watershed. There is concern that refuge wetland basins may be acting as sinks for pesticides and heavy metals received from runoff, or adjacent agricultural practices (see Chapter 3).

c. Water Rights

Due to the perceived reduced levels of water in the Lower Snake River Plain, there has been recent discussion regarding a call* on groundwater from the Upper Snake River Plain. The Refuge's groundwater rights are relatively senior to most of the rights that would be subject to curtailment. Of the nine refuge groundwater rights established for wildlife and/or irrigation use, three could be considered junior rights. Impacts to the refuge resources in relation to the extent of a call would have to be evaluated.

2. Riparian Restoration

Camas Creek and other streams entering the Refuge have been highly altered, off-Refuge, to support agriculture. This has had a profound impact on the riparian habitats along Camas Creek, Rays Lake, and Sandhole Lake. Overbank flooding of Camas Creek now rarely occurs, because flows are reduced in duration compared to historical conditions, and the creek is now deeply incised. As a result, the Refuge's willow shrublands are not being rejuvenated. In addition, willows are subject to increasing browsing pressure from the growing ungulate population.

*A "call" refers to a request by an appropriator for water which the person is entitled to under his decree. Such a call will force those users with junior decrees to cease or diminish their diversions and pass the requested amount of water to the downstream senior making the call.

3. Naturalized Shelterbelt Habitat Maintenance or Restoration

In the 1930s, when the Works Progress Administration (WPA) constructed the refuge headquarters buildings, crews also planted many trees and shrubs around the compound. Since many of the species planted are not native, the Service's default strategy would be to remove the trees and restore the site to native habitat. However over the years this gallery forest has become an important migration stopover site for many species of migratory land birds. A study conducted by the Idaho Bird Observatory in 2005-2006 captured more than 70 species of migratory land birds in and around the headquarters. Also, two rows of cottonwood trees that are directly adjacent to the refuge compound has become a traditional roost site for wintering bald eagles. As many as 90 eagles have been observed in these tree belts at one time.

Most of the cottonwood trees are near the end of their lifespan and are in declining condition. In order for the Refuge to continue to provide habitat for the migratory landbirds, these trees will need to be replaced. Work has begun to replace some of the trees and shrubs in and around the headquarters. However, replacement of these trees has many challenges: securing funds to replace trees, determining what species to plant, and supplying enough water and protection to ensure that the trees survive.

4. Sage-steppe Upland Restoration

While Camas NWR has lost much important sage-steppe habitat, a significant portion of that community is still present on the Refuge and more could be restored. Sage obligates such as sage grouse and pronghorn currently use the Refuge. The actual extent of existing sage-steppe habitat on the Refuge is unknown, but the potential extent (based on soil type) is approximately 3,600 acres. It is imperative that existing sagebrush areas remain intact. A number of threats to sage-steppe exist, such as wildfire and invasive, nonnative vegetation.

Rehabilitation of potential sagebrush sites is the next priority. Extensive crested wheatgrass plantings occupy sandy ecological sites that historically would have supported sage-steppe communities. Crested wheatgrass was established to provide ground cover on abandoned farm fields, or areas denuded by wildfires. It is widely distributed across the Refuge, ranging from monotypic stands where little recolonization by native plant species is evident, to more heterogeneous communities having a representation of both crested wheatgrass and native plants. Wildlife use of crested wheatgrass on Camas NWR is unknown but considered minimal. Some ungulates may graze it in early spring and certain bird and small mammal species may use it for cover.

Rehabilitation of monotypic crested wheatgrass stands to native vegetation will prove challenging. Crested wheatgrass is inherently very competitive due to the species' phenology and decades of seedbed accumulation, among other traits. Also, the high cost of rangeland seeding and restoration undermine the efficacy of restoring sagebrush communities in crested wheatgrass stands.

Other crucial questions include: How important is the Refuge's sage-steppe community for sage-obligate species, such as sage grouse, especially in the context of continuity with high value surrounding habitat? Is there connectivity with other shrub steppe habitats off the Refuge? How have previously described changes in local hydrology affected refuge upland habitat, particularly sage-steppe? Is there any noteworthy wildlife value (forage or other) to crested wheatgrass on the Refuge?

5. Agricultural Cropland Management

Camas NWR currently has a cooperative farming program. Two farmers plant, water, and harvest 80 acres of alfalfa each. The last cutting is left for wildlife. One farmer plants 20 acres of wheat that is left for wildlife. Two other individuals harvest “wild hay” from the Refuge. They are each allowed to remove hay from separate 125 acre parcels. The hay, which the individuals pay for, is predominantly smooth brome grass, quack grass, or both.

The farm fields are heavily used by geese, sandhill cranes, and sage-grouse; they are also used by moose, deer, and elk. The wheat field is used by a variety of bird species during fall migration.

6. Invasive Species Management

Like many national wildlife refuges, Camas continually battles invasive species in its quest to maintain biological integrity. Ironically, Camas Creek, the purveyor of life giving water, is also the primary conduit for invasive species into the Refuge. It washes many seeds into the Refuge from infestations that have taken hold in upstream pastures. Each summer when the creek bed dries, a ribbon of leafy spurge grows for many miles. Other species that line the creek banks are black henbane, musk thistle, Scotch thistle, and houndstongue, which was discovered in 2009.

In the uplands, the problematic species are Russian knapweed, Swainson’s pea, cheatgrass, and to a lesser extent, smooth brome. In some areas crested wheatgrass has become dominant and outcompetes native grasses. Spot treatment with herbicides has been the method of choice in most cases, to avoid impacts to desirable native species such as sagebrush.

Canada thistle grows along the fringe of the Refuge’s wetlands and within its wet meadow habitat. It is a huge challenge because it grows in places that are difficult to access with equipment and limits the use of herbicides. In 2009 the Refuge embarked upon a biological control program for Canada thistle to control this species in inaccessible areas.

Camas NWR cooperates with the Continental Divide Weed Control Area, which works to control weeds upstream of the Refuge.

7. Wildlife-dependent Recreation

The National Wildlife Refuge System Improvement Act of 1997 identified six priority public uses on refuges: hunting; fishing; wildlife observation and photography; environmental education; and interpretation. These uses receive enhanced consideration in planning and management over all other general public uses on refuges. When compatible, these wildlife-dependent recreational uses are to be strongly encouraged. These uses, as well as other current or proposed uses, receive an extensive compatibility review in the CCP before being allowed. Under FWS compatibility policy (603 FW 2), refuges with limited staffing and funding are required to make efforts to obtain additional resources or outside assistance to provide wildlife-dependent recreational uses, and to document those efforts before determining that any of these uses are not compatible.

The Camas NWR must manage an ever-increasing request for visitation and demand for visitor services programs with a very small staff. Currently, the visitor services program at the Refuge is mostly “self serve,” with informational kiosks and interpretive displays. To date emphasis has been placed on maintaining visitor facilities, welcoming and orienting visitors, answering information requests, and law enforcement during the bird hunting season.

The main issue to be addressed in the CCP is balancing internal and external demands for increased refuge recreation with the "Wildlife First" mission of the National Wildlife Refuge System and the wildlife conservation purposes of Camas NWR.

8. Global Climate Change

Climate change will have effects on species and their habitats throughout the National Wildlife Refuge System. Mean global temperature has risen rapidly during the past 50 years and is projected to continue increasing throughout the twenty-first century. Changes in precipitation, diurnal temperature extremes, and cloudiness—as well as sea level rise—are some of the factors that are projected to accompany the warming. A coherent pattern of poleward and upward (elevation) shifts in species distributions, advances in phenology of plants, and changes in the timing of arrival of migratory birds and other animals on seasonal ranges have been well documented. The effects of most concern are those that may occur to NWRS trust species that have limited dispersal abilities. Climate related changes in the distribution and timing of resource availability may cause species to become decoupled from their resource requirements.

Managing the "typical" challenges to the NWRS requires accounting for the interaction of climate change with other stressors in the midst of substantial uncertainties about how stressors will interact and systems will respond. Many NWRS trust species are migratory. Breeding, staging, and wintering habitats are typically dispersed throughout the system and on non-NWRS lands. The superimposition of spatially and temporally variable warming on spatially separated life history events will add substantial complexity to understanding and responding to ongoing conservation challenges. Climate change will act synergistically with other system stressors, and is likely to impose complex non-linear system responses to the "typical" challenges. It will be extremely difficult to clearly understand the influence of non-climate stressors on habitats, populations, and management actions without accounting for the effects of climate change. Local- to national-scale managers will face the dilemma of managing dynamic systems without fully understanding what, where, or when the climate related changes will occur, or how they might best be addressed.

While NWRS policy provides a basis for ecological sustainability, climate change presents new challenges at unprecedented scales for maintaining biological integrity, diversity, and environmental health of refuges and the Refuge System. Explicit performance goals and objectives tied to biological integrity, diversity, and environmental health of refuges and the Service's conservation targets will be needed to assess the degree and effectiveness of NWRS response to the challenges of climate change.

9. Inventory, Monitoring, and Adaptive Management

Camas NWR needs natural resource inventory and monitoring protocols and a systematic program to quantify the efficacy of management actions. The CCP effort should address a process to acquire needed resource information and the means to make effective, science-based managerial decisions for resource protection. At a minimum, the strategy should consist of a framework for completion of basic resource inventories upon which monitoring efforts can be based; creation of experimental monitoring to evaluate management actions and design; and implementation of operational monitoring of critical processes and parameters.

10. Historic and Cultural Resource Management

Over time Camas NWR has been in consultation with SHPO on various projects to ensure compliance with historic preservation laws. To date most consultations have involved structures located at the refuge headquarters and living quarters. A field study was conducted in 2005 found some sites that were potentially eligible for the National Historic Register (see Chapter 5).

The most recent survey of the structures at the Camas NWR headquarters listed three of the buildings as eligible for listing in the National Register of Historic Places. The three buildings identified are the Main Office/Quarters # 1, the Old Shop, and the Old Office. These three buildings were built during the Works Progress Administration days in the late 1930s and early 1940s. Also built during this time were water control structures and bridges. To date not all of these have been evaluated to determine if they would be eligible for the National Register of Historic Places (NRHP).

In 2005 an Archaeological Investigation was completed on Camas NWR, but only in specific areas that were identified as possible locations for prescribed fire or seeding operations. Seven separate units were identified and surveyed by North Wind Inc. Five separate sites were located that were considered potentially eligible to the NRHP and required avoidance. Sites identified included two historic canals, a stone circle, an irrigation canal, and one historic trash dump.

11. Land Protection and Acquisition

The staff of Camas NWR has identified some priority areas both within and outside the current acquisition boundary that could provide benefits to wildlife if the chance of acquisition were to occur. One in-holding of about 40 acres exists near the refuge headquarters and acquisition should be given priority in the event of a willing seller. This area is a true in-holding and is surrounded by the Refuge on all four sides. At the time of this writing, acquisition is pending on another, 80 acre inholding, the Bunker Hill Tract.

Another potentially beneficial area outside the current acquisition boundary is the corridor of lands along Warm Creek. These lands are in private ownership. No surface water is allowed to flow through Warm Creek, unless the area is in a flood emergency. That surface flow would provide an important riparian corridor, but would also add surface recharge to Sandhole Lake, which is one the most important wetlands on Camas NWR.

Any land that comes up for sale with Camas Creek within its boundaries should also be closely looked at for acquisition potential. Benefits of acquiring such lands would include protecting water quality, providing riparian habitat for migratory landbirds, and increasing habitat connectivity.

1.8.2 Issues Outside the Scope of the CCP

While CCPs are very 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.

Livestock Grazing. Reassessing the use of cattle grazing on the Refuge to improve habitat was suggested during public scoping. Livestock grazing is an economic use that must support achievement of refuge purposes and System Mission in accordance with 50 CFR 29.1. Livestock grazing was not included in the alternatives, because under current management domestic livestock grazing as a management tool is not required to meet refuge objectives. Livestock grazing was deemed incompatible with Camas NWR purposes in 1993.

The Department of the Interior and the U.S. Fish and Wildlife Service were sued on October 22, 1992, for alleged violations of the National Wildlife Refuge System Administration Act, the Refuge Recreation Act, and the National Environmental Policy Act. The suit (*Audubon et al. v. Babbitt*) alleged incompatible secondary uses were being permitted on nine refuges and that the Department of Interior was failing to follow legal requirements in allowing similar uses throughout the Refuge System. Livestock grazing was specifically cited in the suit as an incompatible secondary use at Camas NWR.

The suit was settled out of court on October 20, 1993. The settlement agreement made several direct decisions on secondary uses on the national wildlife refuges identified in the suit. Through the settlement agreement, the Service discontinued grazing at Camas NWR in 1994. Therefore, grazing appropriateness and compatibility was not re-evaluated in the development of the Camas NWR CCP/EA as a future management strategy on the Refuge.

Restoration of Sage-steppe, Camas Creek, and Camas Wetlands to Pre-settlement Conditions. Camas NWR uplands and wetlands functioned much differently prior to development of commercial agriculture and irrigation. Current alterations to the historic system have been substantial and include type conversion of thousands of acres of sagebrush habitat to crop production and depletion of spring flows and declining groundwater levels from the collective effect of drought, changes in surface water irrigation acreage and practices, and groundwater pumping. These effects have led to major structural changes to the Camas NWR including:

1. Altered hydrologic groundwater and surface water regimes
2. Altered Camas creek morphology and flows
3. Fragmented landscapes
4. Altered fire regimes

Because of the strategic importance of Refuge wetlands for supporting wildlife movement and long-term conservation of wetland-dependent species, migratory birds and other wetland-dependent wildlife species will remain a primary focus of refuge management in the CCP. However, restoring the natural hydrology of the Camas ecosystems is not practical at this time. A project of this magnitude would require major alterations that would affect many outside interests and involve considerable expense. Therefore the CCP assesses management options (alternatives) that mimic the natural formative hydrologic processes and provide variable extents of wetland habitats representative of the historic wetlands.

Camas Creek and Watershed Restoration as Primary Emphasis: Restoration of unimpeded hydrologic processes throughout a large portion of Camas Creek was considered by the Service, but was not carried forward for detailed analysis. Although this scenario could result in benefits such as increased riparian habitat, an aesthetically pleasing view, improved water quality, and a reconnected floodplain, it could also lead to the loss of prime wetland habitat at Camas NWR, thus falling short of refuge purpose and trust resource responsibilities, as well as the loss of senior water rights within the watershed.

Currently, the Camas NWR provides the majority of sustainable wetland habitat in the Sinks Basin. Camas NWR plays a vital role in providing habitat for waterfowl and waterbirds during breeding and migration. It is for this reason that refuge staff must first focus on understanding and increasing aquatic health Refuge-wide before full watershed scale restoration can be addressed. For these reasons, the Service rejected a detailed analysis of this alternative.

Exercise of Tribal treaty rights on the Refuge. The Service consulted with the Shoshone-Bannock Tribe during the development of the Draft CCP/EA. While the Tribe and the Service discussed tribal treaty rights, including the right to hunt on open and unclaimed lands, the Service believes that defining the application of tribal treaty rights is outside the scope of this CCP planning effort. Neither the existence of this CCP/EA nor any portion of its contents is intended to enlarge or diminish treaty rights, or to have any influence over the resolution of any unadjudicated treaty rights. At their request, the Service will meet with the Shoshone-Bannock Tribe independent of the CCP process to develop Memorandums of Understanding (MOUs) and other instruments that are respectful of the rights and needs of the Tribe, in accordance with Service Tribal policies and consistent with preserving the natural and cultural resources of Camas NWR.

1.9 Refuge Vision

Refuge vision statements are broad general statements that describe the long-range desired future condition of national wildlife refuges, well beyond the 15-year lifespan of the CCP. The vision statement for Camas NWR will serve as a challenging and worthwhile long-range target toward which people can direct their energies.

> *Long before Camas NWR was established in 1937 in eastern Idaho's high desert, wet meadows sustained by Camas Creek provided abundant insect life for waterbirds and sage-grouse to rear their broods. Sandhole Lake provided a year-round water source for pronghorn, mule deer, and people.*
>
> *Today, much of the surrounding landscape has been transformed by agriculture. But Camas NWR still provides a serene setting where tundra swans glide on pools framed by a brilliant orange sunrise. Here visitors can see a pure white V of snow geese pressed against a brilliant blue sky, or search for rare warblers in the willows along Camas Creek. Photographers try their skill at capturing the fall ritual of a bull elk gathering his herd, and visitors even brave midwinter cold to watch bald eagles returning to roost in the Refuge's cottonwood trees.*
>
> *Camas NWR will continue to provide wetland and sage-steppe habitat for migratory birds and other native wildlife. Here, people of all ages and abilities will have the opportunity not only to enjoy, but to better understand the habitats and wildlife of the eastern Snake River Plain, and the importance of natural systems. We will use water resources wisely and become a model for energy and water conservation. We will work with our partners to sustain functional ecosystems in a changing environment.*

1.10 Refuge Goals

1.10.1 Wildlife and Habitat Goals

Goal 1 (Native Habitats):

Maintain and protect the existing integrity of functional native habitat and restore the natural range of variability and resiliency of degraded habitats.

Goal 2 (Naturalized Habitats):

Provide high quality forage and cover habitat to increase fitness (e.g., physical condition, survival, reproduction) for migratory birds.

Goal 3 (Agricultural Habitats):

Provide a supplemental on-Refuge forage base for carbohydrate and protein requirements of migratory waterfowl and landbirds within the Pacific and Rocky Mountain migratory corridors.

1.10.2 Public Use Goals

Goal 4 (Wildlife-dependent Recreation and Public Use):

Increase public understanding and appreciation of wildlife, and build support for Camas NWR by providing opportunities for all visitors to participate in safe, quality wildlife-dependent recreation and education programs, while minimizing wildlife disturbance or other impacts to wildlife populations or habitats.

1.11 Planning Process

A core planning team, consisting of a Project Leader, Deputy Project Leader, Refuge Manager, Refuge Biologist, Complex Planner, and a Regional Planner, began developing the CCP in January 2010. Reviewers and subject matter experts from various divisions within the Service assisted in CCP development, particularly in reviewing preliminary goals, objectives and strategies, and in developing alternatives. A list of core team members, and professionals from other agencies and Service programs who assisted with CCP development is located in Appendix K.

Early in the planning process, the core team identified 40 priority wildlife species (focal species) for the Refuge, their associated habitats, and other species that would benefit from managing the focal species. These focal species are listed in Appendix E. Wildlife and habitat goals and objectives were designed directly around the habitat requirements of species designated as priority resources of concern. The analytical framework for analyzing the resources of concern and for devising appropriate conservation objectives and strategies was based on the Service's Draft *Identifying Resources of Concern and Management Priorities for a Refuge: A Handbook* (USFWS 2008b).

Public use planning centered on developing goals, objectives and strategies around the "Big Six" wildlife-dependent public uses—hunting, fishing, wildlife observation and photography, and environmental education and interpretation—and the transportation and infrastructure needs associated with those uses.

Public scoping began in the summer 2010. In August 2010 scoping meetings were held in Hamer and Idaho Falls, Idaho. Public commentary was also solicited through distribution of a planning update to the refuge mailing list. A summary of public involvement to date is in Appendix L. An internal draft was distributed to Service Region 1 reviewers in February 2013. All changes requested by reviewers and extended team members and actual changes made were documented.

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Chapter 2
Management Alternatives, Goals, Objectives and Strategies

USFWS

Chapter 1 Introduction and Background

Chapter 2 Management Alternatives, Goals, Objectives and Strategies

Chapter 3 Physical Environment

Chapter 4 Biological Environment

Chapter 5 Human Environment

Chapter 6 Environmental Effects

Appendices

Chapter 2. Alternatives, Goals, Objectives, and Strategies

2.1 Consideration in Alternative Designs

During development of the alternatives for this Draft CCP/EA, the Service reviewed and considered a variety of resource, social, economic, and organizational aspects important for managing the Refuge. These background conditions are described more fully in Chapters 3, 4, and 5. As is appropriate for a national wildlife refuge, resource considerations were fundamental in designing alternatives. 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."

The Refuge's planning team reviewed available scientific reports and studies to better understand ecosystem trends and the latest scientific recommendations for species and habitats. The team met with staff from local, State, Native American Tribes, and Federal agencies, and elected officials to ascertain priorities and problems as perceived by others. Refuge staff met with refuge users, nonprofit groups, and community organizations to ensure that their comments and ideas were considered during Draft CCP/EA development.

2.2 Actions/Alternatives Considered but Not Developed

The details of public participation can be found in Appendix L. During development of the alternatives, the planning team considered the actions detailed below. All of these actions were ultimately eliminated for the reasons provided.

Restoration of Camas NWR to Pre-Settlement Conditions. Camas NWR uplands and wetlands functioned much differently prior to development of commercial agriculture and irrigation. Current alterations to the historic system have been substantial and include type conversion of thousands of acres of sagebrush habitat to crop production and depletion of spring flows and declining groundwater levels from the collective effect of drought, changes in surface-water irrigation acreage and practices, and groundwater pumping. These effects have led to major structural changes to the Camas NWR including:

1. Altered hydrologic groundwater and surface water regimes
2. Altered Camas Creek morphology and flows
3. Fragmented landscapes
4. Altered fire regimes

Wetland, migratory birds, and other wetland-dependent wildlife species will remain a primary focus of refuge management. However, restoring the natural hydrology of the Camas NWR ecosystems is not practical at this time. A project of this magnitude would require major alterations that would affect many outside interests and involve considerable expense. Therefore the CCP will assess management options (alternatives) that mimic the natural formative hydrologic processes and provide variable extents of wetland habitats representative of the historic wetlands.

Camas Creek and Watershed Restoration as Primary Management Emphasis: Restoration of unimpeded hydrologic processes throughout a large portion of Camas Creek was considered by the Service, but was not carried forward for detailed analysis. Although this scenario could result in benefits such as increased riparian habitat, an aesthetically pleasing view, improved water quality, and a reconnected floodplain, it could also lead to the loss of prime wetland habitat at Camas NWR, thus falling short of refuge purpose and trust resource responsibilities, as well as the loss of senior water rights within the watershed.

Many rivers and streams flowing from the north side of the Snake River plain are fed by mountain springs and snowmelt. As these rivers and streams reached the Snake River Plain they encounter areas where the water disappeared into the ground (sink) and provide direct recharge for the aquifer. If and when the aquifer was fully recharged the excess water would continue to flow across the landscape and eventually reach the Snake River. Currently, the Camas NWR provides the majority of sustainable wetland habitat in a group of watersheds called the lost streams of Idaho, or the “Sinks Basin.” Camas NWR plays a vital role in providing habitat for migratory bird species during breeding and migration within the “Sinks Basin.” It is for this reason that refuge staff must first focus on understanding and increasing aquatic health Refuge-wide before full watershed scale restoration can be addressed. Therefore the Service rejected a detailed analysis of this alternative.

Upland Restoration as Primary Management Emphasis: The Service looked at the option of elevating upland restoration as the predominant habitat management emphasis of the Refuge, due to limitations in groundwater availability for wetland management. This alternative would have severely limited wetland and riparian habitat management and diverted available resources away from refuge purposes. The Service therefore rejected a detailed analysis of an upland emphasis alternative. However, an alternative where upland and wetland/riparian management have equal emphasis was developed by the Refuge.

Livestock Grazing. Reassessing the use of cattle grazing on the Refuge to improve habitat was suggested during public scoping. Livestock grazing is an economic use that must support achievement of refuge purposes and the NWR System Mission in accordance with 50 CFR 29.1. Livestock grazing was not included in the alternatives, because under current management domestic livestock grazing as a management tool is not required to meet refuge objectives and was deemed incompatible with Camas NWR purposes in 1993.

The Department of the Interior and the U.S. Fish and Wildlife Service were sued on October 22, 1992, for alleged violations of the National Wildlife Refuge System Administration Act, the Refuge Recreation Act, and the National Environmental Policy Act. The suit alleged incompatible secondary uses were being permitted on nine refuges and that the Department of Interior was failing to follow legal requirements in allowing similar uses throughout the Refuge System. Livestock grazing was specifically cited in the suit as an incompatible secondary use at Camas NWR.

The suit was settled out of court on October 20, 1993. The settlement agreement made several direct decisions on secondary uses on the national wildlife refuges identified in the suit. Through the settlement agreement, the Service discontinued grazing at Camas NWR in 1994. Grazing appropriateness and compatibility will not be re-evaluated in the development of the Camas NWR CCP/EA as a future management strategy on the Refuge.

Expanding Off-Refuge Recreational Opportunities. Suggestions were made for the Refuge to work with the County to increase off-Refuge wildlife observation opportunities along the south and east boundaries of the Refuge for pedestrians, bicyclists, and others. The Fish and Wildlife Service has no jurisdiction over adjacent land at Camas NWR. While the CCP does assess alternatives to increase access and opportunities for wildlife-dependent recreation on the Refuge, persons interested in off-Refuge outdoor activities and visitation would need to work with the State of Idaho, County, or private landowners.

2.3 Alternative Descriptions

2.3.1 Features Common to All Alternatives

All alternatives contain some common features. These are presented below to reduce the length and redundancy of the individual alternative descriptions.

Implementation subject to funding availability. Under each alternative, actions will be implemented over a period of fifteen years as funding becomes available. Project priorities, and funding needed to implement the CCP, are described in Appendix C. The Refuge will continue to work with partners to implement the CCP by sharing science, providing updates on successes and challenges, initiating discussions, encouraging participation, and hosting working groups.

The CCP sets priorities for implementation. Actions will be implemented over a period of 15 years as funding becomes available.

State, local, and interagency coordination. Under all alternatives, the Service would continue to maintain regular discussions with the Idaho Department of Fish and Game (IDFG). Key topics of discussion would include habitat management for waterfowl and other migratory birds; updates of waterfowl management plans; wildlife monitoring; hunting and fishing seasons and regulations; and management of Federal and State-listed species.

Refuge management efforts, such as invasive species control and land and water acquisitions, will be coordinated with the adjacent Idaho Department of Fish and Game (IDFG) Mud Lake and Market Lake Wildlife Management Areas (WMAs), the Continental Divide Weed Management Area (CWMA), and Jefferson County, ID.

Tribal coordination. The Service would coordinate and consult with the Shoshone-Bannock Tribes of Idaho on a regular basis regarding issues relating to the traditionally shared resource interests. The Service would also seek assistance from the Tribe, as needed, on issues related to cultural resources education and interpretation, special programs, and the National Historic Preservation Act (NHPA).

Maintain Waterfowl Habitat in Support of Pacific Flyway Planning Efforts. The Pacific Flyway Council (PFC) prepares management plans for populations of swans, geese, and sandhill cranes in the Pacific Flyway (www.pacificflyway.gov). These plans help State and Federal agencies cooperatively manage migratory game birds under common goals. Defining the role and extent of waterfowl habitat, including sanctuary areas (areas closed to hunting and significant disturbance from other public uses) is a component of Pacific Flyway waterfowl management plans. Camas NWR will continue to manage waterfowl habitat and will make adjustments as needed, in support of these plans (see Chapter 1).

Maintenance and updating of existing facilities. Periodic maintenance and updating of refuge buildings and facilities will be necessary regardless of the alternative selected. Periodic updating of facilities is necessary for safety and accessibility, reducing the Refuge's carbon footprint, and to support staff and management needs.

Adaptive Management. The Refuge will be using an adaptive management (AM) decision making process to implement management strategies authorized in the Comprehensive Conservation Plan (CCP). Adaptive management is a science-based public participation process for evaluating and adjusting a conservation effort relative to goal achievement as experience and knowledge are gained through implementation, study and discussion. The Refuge and its collaborative partners support the fact that AM promotes flexible decision making which can be adjusted in the face of uncertainties, as outcomes from management actions and other events become better understood. As the CCP is implemented, AM will help the Refuge achieve diverse goals while enhancing wildlife benefits, advancing scientific knowledge, and improving working relationships among stakeholders.

The principle of AM is based on the recognition that ecosystem function is inherently complex and often results in knowledge gaps. AM implementation means a firm commitment to the development of measurable outcomes and the application of rigorous evaluation and monitoring methods to determine whether management goals are being met. Careful monitoring of these actions advances scientific understanding and helps adjust policies or operations as part of an on-going learning process. This is not a "trial and error" process but rather emphasizes "learning while doing," which recognizes the importance of incorporating new information as it becomes available. AM requires flexibility and an ability to acknowledge risks/failures while using new knowledge in a constructive manner to make adjustments while building a foundation for ongoing learning/adjustment.

The Refuge is committed to a rigorous and inclusive AM approach to enhance public confidence in the ability of the Refuge to transfer the theory to practice. The Refuge recognizes as it moves forward with CCP implementation that there is a critical need for transparency. This transparency, as it pertains to AM, needs to include both the learning and decision making processes. The following discussion describes how the Refuge will move forward through AM.

- INFORMATION SHARING/LEARNING: The Refuge is committed to an AM process that will bring diverse interests together through various forums to share information and site specific results so that all those engaged, including the Refuge, can learn together. These forums will evolve through time but would include mechanisms such as the Aquatic Health Coalition, the Ecology Working Group and an evolution of the Collaborative Planning Group. The timing and frequency of information sharing/learning will be determined by how rapidly new information is being acquired, level of partners' interest/engagement, ecological cycles and the forum being used. The Refuge will share the results of its inventory and monitoring work. Additionally, the Refuge will be responsive to partners' requests for open discussion and collaboration in assessing the need for adaptive changes in management.
- DECISION MAKING: As the Refuge and partners learn through the AM process, new information may show the need for adjustments, confirm existing strategies or identify additional information needs. Based on the best information available at the time, the Refuge will make decisions for future management actions. As with the sharing/learning aspects of AM, the Refuge recognizes the importance of transparency for decisions made during the AM process. The Refuge is committed to bringing together interested parties to assist with, the evaluation of available information and consultation about management options and their implications prior to making course changing decisions. This process does not diminish the Refuge's legal authority to make decisions, but rather serves to enhance the decision making

process by enabling the Refuge to approach issues from multiple perspectives, thereby finding creative solutions to complex challenges.

Inventory and Monitoring. Current and proposed new inventorying and monitoring (I&M) policy (863 FW 1 to supersede 701 FW 2) requires refuges to prepare I&M plans. Refuge I&M plans have two sequential phases (parts):

1. A prioritized list of surveys for approval by the refuge supervisor.
2. Individual protocols based upon the finalized list of surveys.

An interim (2014-2015) I&M goal (Goal 4), objectives (Objectives 4.1-4.4), and near-term strategies are developed for this CCP. A full I&M step down plan will be developed for Camas NWR in 2016. The Refuge I&M Plan will consist of three components. The first is a prioritized list of surveys and methods for a refuge. The second table provides a justification regarding how each survey informs refuge resource management decisions. The third table focuses on time frames (calendar) to complete training, fieldwork, data management and analyses, and reporting for each survey.

Invasive species control. Because invasive plants and animals currently represent a threat to the Refuge's wildlife and habitat, control of invasive species will be a high-priority management activity in all alternatives. State-listed noxious weeds would continue to be a primary management concern. Non-noxious weeds such as common mullein, horseweed, and tumble mustard also limit the Refuge's ability to provide high-quality habitat for migratory birds and other trust species, 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 Refuge's Integrated Pest Management Plan is included in this CCP (Appendix F).

Integrated Pest Management (IPM). In accordance with 517 DM 1 and 569 FW 1, an integrated pest management (IPM) approach would be used, where practicable, to eradicate, control, or contain pest and invasive species (herein collectively referred to as pests) on refuge lands. IPM would 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 would be needed on refuge lands, the most specific (selective) chemical available for the target species would be used unless considerations of persistence or other environmental and/or biotic hazards would preclude it. In accordance with 517 DM 1, pesticide usage would be further restricted because only pesticides registered with the 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.

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

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

See Appendix F for 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 would be evaluated for potential effects to refuge biological resources and environmental quality. These potential effects would be documented in "Chemical Profiles" (see Appendix F). Pesticide uses with appropriate and practical best management practices (BMPs) for habitat management as well as cropland/facilities maintenance would be approved for use on refuge lands where there likely would be only minor, temporary, and localized effects to species and environmental quality based upon non-exceedance of threshold values in Chemical Profiles. Hazard analysis and critical control points planning (HACCP) is a tool to aid natural resource managers identify critical control points in their activities to decrease the spread of invasive species. The HACCP Wizard Version 2.04 (http://www.haccp-nrm.org/Wizard/default.asp) will be used to construct plans for staff, contractors, volunteers, and other users of the Refuge to evaluate their activities and address ways to conduct their activities to limit the chance of spreading invasive species.

Cooperative Farming. The Refuge will evaluate the use of cooperative agreements (CLMAs) for crop cultivation, haying, or the harvest of vegetative products, including plant life, growing with or without cultivation on the Refuge. CLMA are share-in-kind agreements whereby the cooperator is allowed to farm on the Refuge in exchange for work to benefit management of the Refuge (50 CFR 29.2).

Water Rights. The right to use water on the Refuge is managed through the State of Idaho's Department of Water Resources. Water rights in Idaho are managed by two basic principles: (1) first in time, first in right, and (2) beneficial use. All water use on the Refuge has some form of a State certified water right. To protect the habitats and values associated with springs, the Service will take steps to file a groundwater right under all alternatives. Refuge objectives are to obtain water supplies of adequate quantity and quality, and the legal rights to use that water, for development, use, and management of Service lands and facilities, and for other congressionally authorized objectives such as protection of endangered species and maintenance of instream flows (430 FW 1).

These objectives will be achieved at Camas NWR by: a) Reviewing and documenting the need for and use of refuge water; b) Identifying and evaluating water rights appurtenant to, or which may be applied to beneficial use on, lands proposed for protection, restoration, enhancement, development, or acquisition; c) Asserting appropriative, riparian, vested, and reserved water rights in proper administrative and judicial forums; d) Submitting applications for new State appropriative water rights and changes to existing State appropriative water rights according to State law; e) Providing technical and evaluation data to the Solicitor and Department of Justice to resolve and water rights controversies that may develop through negotiation and litigation; f) Identifying and pursuing opportunities to acquire water through mitigation, settlement of potential or future litigation, legislation, or other means to satisfy Service objectives; and g) Communicating water rights technical and policy guidance to project leaders and Service managers.

Removal of In-Stream Obstructions. The Refuge would accommodate downstream water users for the removal of in-stream obstructions in Camas Creek, as per the conditions of the Mud Lake Water Decree.

Fire Management. The goal of fire management is to plan and implement actions that help accomplish the mission of the National Wildlife Refuge System. That 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 (095 FW 3.2).

The current Southeast Idaho National Wildlife Refuge Complex Fire Management Plan (2009; Appendix G) is a working reference for fire program implementation that formally documents the fire management program elements. The Fire Management Plan is to be written to meet Department and U.S. Fish and Wildlife Service requirements that every area with burnable vegetation must have an approved FMP. An approved FMP allows the Southeast Idaho National Wildlife Refuge Complex to consider a wide range of management responses to wildfires and to conduct prescribed fires; without it, prescribed fires cannot be conducted and only wildfire suppression strategies may be implemented.

In compliance with the USFWS requirement that refuges review and/or revise fire management plans (FMPs) at a minimum of 5-year intervals or when significant changes are proposed, such as might occur if significant land use changes are made adjacent to USFWS lands (621 FW 2), the FMP will be revised within one year of CCP completion. The revised FMP will address objectives, strategies, and resource considerations that are identified in the CCP, for example use of prescribed fire, response to wildfire incidents, and rehabilitation/stabilization of areas burned by wildfire. The revised FMP would be a step down management plan from the CCP and is a fundamental strategic document that guides the full range of fire management related activities including organization, facilities, equipment, staffing needs, activities, timing, locations, and budgetary procedures.

Law Enforcement. The goal of law enforcement at Camas NWR is to protect natural resources and maintain the peace and safety of the visitors and employees of the Refuge. Law enforcement activities will include patrols to establish and maintain an effective, professional, and courteous law enforcement presence to eliminate unauthorized uses by creating and fostering partnerships with the County Sheriff, IDFG, BLM, Tribe, and FS Law Enforcement to provide mutual aid benefits. The Service will investigate reports of violations in a timely fashion.

Cultural resource protection and compliance. Cultural resource management is an integral part of Camas National Wildlife Refuge management, not just because the law mandates it but for the unique information it can bring to our understanding of the environment.

Actions with the potential to affect cultural resources will undergo a thorough review before being implemented, consistent with the requirements of cultural resource laws. All ground-disturbing projects will undergo a review and compliance with the National Historic Preservation Act.

The following cultural resource issues are addressed in the goals and objectives of the Refuge's Cultural Resource Management Plan (Appendix H):

1. Maintaining the integrity of the Refuge's cultural resources while managing and restoring wildlife habitat.
2. Consulting with federally recognized tribes on the management of Native American cultural resources in a manner that facilitates the mission of the Refuge and addresses issues of importance to the Tribes.
3. Working and consulting with federally recognized tribes on the disposition of human remains, funerary objects, sacred objects and objects of cultural patrimony as defined under the Native American Graves Protection and Repatriation Act.
4. Incorporating cultural resources into interpretive and educational programs that illustrate humankind's interaction with the natural world.

Climate Change. Refuge staff will participate in and contribute to climate change assessment efforts, including those underway at a landscape scale, such assessments being conducted by the Great Northern Landscape Conservation Cooperative (LCC). LCCs are formal science-management partnerships consisting of the Service, other Federal agencies, states, tribes, NGOs, universities, and other entities. LCCs provide science support, biological planning, conservation design, research, and design of inventory and monitoring programs to address climate change and other environmental stressors in an integrated fashion. As needed, objectives and strategies will be adjusted to assist in enhancing refuge resources' resiliency to climate change. Refuge staff will also continue to pursue and engage in efforts to reduce energy consumption in refuge operations, including the use of fuel efficient vehicles.

Reduce the Refuge's carbon footprint. The Service has developed a Strategic Plan for Responding to Accelerating Climate Change in the 21st Century (2010), and a five-year 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 replacing its current vehicles with more fuel efficient vehicles, and by 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.

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 Draft CCP/EA, the planning team completed a wilderness review (Appendix D). This review concluded that the Refuge is not suitable for wilderness designation.

Emphasis on wildlife-dependent public uses. The National Wildlife Refuge System Administration Act, as amended, mandates that NWRs provide wildlife-dependent public uses, including hunting, fishing, wildlife observation and photography, interpretation, and environmental education, when these uses are compatible with the needs of wildlife. Therefore, providing compatible wildlife-dependent public uses is a high priority in all alternatives.

Volunteer opportunities and partnerships. Volunteer opportunities and partnerships are key components of the successful management of public lands, and are vital to refuge programs, plans, and projects, especially in times of static or declining budgets. In the future, successful implementation of native habitat restoration, inventory and monitoring, and environmental education and interpretation programs will require the use of partnerships and volunteers.

Participation in planning and review of regional development activities. The Service will actively participate in planning and studies pertaining to future industrial and urban development, transportation, recreation, contamination, and other potential concerns that may affect refuge resources. The Service will continue to cultivate working relationships with county, State, and Federal agencies to stay abreast of current and potential developments, and will use outreach and education as needed to raise awareness of refuge resources and dependence on the local environment. The Refuge will ensure compliance with regulatory statutes, when local partnerships cannot resolve issues affecting refuge habitats.

Land Protection and Conservation. We will participate in area conservation planning efforts in cooperation with other refuges; State, Federal, and local agencies; and interested parties to assess and identify land conservation priorities. Land conservation as part of the NWRS may include land protection such as fee title acquisition, conservation easements, and cooperative agreements.

In all alternatives, the Service would work with local partnerships to identify and consider both small scale and landscape scale conservation priorities within Upper Snake River Area. The Service will foster social-ecological objectives to respond to and shape ecological change, by attempting to: understand the habitat needs of key wildlife species, understand effects of climate change, conserve water resources, increase groundwater recharge to benefit depleted water tables, decrease the dependence of non-renewable energy sources, and decrease soil erosion.

Under all alternatives, a Preliminary Project Proposal (PPP) would be developed within three years of CCP completion. If the PPP by the USFWS Director is approved, a more detailed Land Protection Planning (LPP) process would then be initiated to address large-scale land protection alternatives and help to prioritize adjoining lands that are most critical for protection of refuge water quality and quantity; have the highest quality sage-steppe and wetland habitat; and provide the best opportunities for habitat restoration. The LPP strategies would be developed with input from the public, State, county, non-governmental organizations, and other refuge partners to ensure that any local land protection and acquisition occurs in a coordinated and efficient manner. A separate decision making NEPA process would consider a range of alternatives for possible new land protection efforts. Tools for land protection include easements, agreements, and fee title acquisition.

On a smaller scale the Refuge will actively pursue land protection and acquisition within and adjacent to the boundary of Camas NWR. Land protection actions will be prioritized for: lands with existing commitments to purchase or protect; lands with active water rights attached to them; biological important habitat for wildlife species; significance of the area to refuge management and administration; and lands with existing or potential threats to wildlife habitat, which need to be remediated.

2.3.2 Alternative Description Summary

A brief description of each alternative follows. Maps displaying the three alternatives follow the alternatives descriptions. Maps 3-5 display habitat areas proposed under each alternative, while maps 6-8 display public use facilities proposed under each alternative.

Alternative 1: Provide Breeding Habitat; Prioritize Non-Consumptive Wildlife-dependent Recreation (Current Management)

Wildlife and Habitat:

The Refuge would continue to be managed to provide consistent deep wetland habitats April through October, to support reliable levels of annual waterfowl production. Providing hemi-marsh habitat (habitat with approximately equal areas of emergent vegetation and open water) is the primary management emphasis, which frequently occurs at the expense of advancing management for improved riparian habitat function. Deeply flooded wetlands would be maximized by diverting 58.1 cfs of Camas Creek surface flows, consistent with refuge water rights, from April through July in an average flow year, into six managed wetland impoundments. Groundwater pumping would compensate for surface water seepage into the ground, and would be used to maintain deep wetland habitat through October.

Camas Creek would remain highly altered (diked and incised). Minimal overbank flooding would occur approximately one in every six years, in the late spring to early summer. Overbank flood events that inundate the historic Camas Creek floodplain on the Refuge would be rare (approximately once every 20 years). The majority of Camas Creek surface waters (58.1 cfs) would continue to be diverted into managed wetlands. Camas Creek flows below the diversion structure would only occur above 58.1 cfs when additional flow is released past the diversion structure downstream through Camas Creek (In an average year Camas Creek flows below the refuge point-of-diversion would be expected to occur for only 3 to 6 weeks). Species benefiting from the resulting riparian habitat are migratory land birds, upland game birds, and big game species.

Upland habitats (sage steppe and grasslands) management would be minimal. Upland maintenance and protection would occur through invasive species control and monitoring. Areas of upland habitat impacted by wildfire, and 90 acres of previously farmed lands that are now in brome and quack grass monocultures, would be rehabilitated with native grasses and shrubs.

Shelterbelt habitats would be managed for tall mature cottonwoods with a native understory of smaller trees and shrubs for the benefit of migratory landbirds. Cottonwoods within naturalized shelterbelt habitats would continue to be irrigated and large trees near the end of their life-span would be replaced. Non-native shelterbelt understory trees and shrubs would continue to be replaced with species that are native to Idaho.

The Refuge would cooperatively farm about 160 acres in the Well #7 and #9 fields, consisting of 140 acres of irrigated alfalfa and 20 acres of irrigated small grain for waterfowl, cranes, upland game birds, and big game species that inhabit the Refuge. The Refuge would use cooperative farming agreements with area farmers to plant agricultural fields using refuge-owned irrigation equipment (Well #7 Field) and privately owned irrigation equipment (Well #9 Field). Approximately 330 acres of formerly farmed fields would be flood-irrigated annually, and 150 acres of these fields would be hayed annually.

Public Use:

The Refuge would continue to provide quality wildlife observation and photography opportunities. Wildlife observation prospects are enhanced by the maintenance of a ½ mile birding trail within shelterbelt habitat and a viewing platform overlooking Camas Creek riparian habitat. A 6.3 mile, two-way auto tour route is maintained year round, but may be closed at times in winter due to ice or snow. In addition to the auto tour route, 6.5 miles of refuge roads (leading to and within the north and south waterfowl and upland game bird hunting areas) are open to vehicle and pedestrian traffic during the hunt season. Year-round hiking, biking, jogging, cross-country skiing, and/or snowshoeing are allowed on approximately 27 miles of unimproved service roads. Off-road hiking is permitted throughout the Refuge from July 15 through February 28. Dog walking, with pets on leash or under close control, is allowed in areas where other public uses occur. Horseback riding is prohibited. (Although the use of horses by grazing permittees on the Refuge was once allowed, this was discontinued when the grazing program was terminated in 1994. The Refuge has never been officially opened to horseback riding by the general public.)

There are currently no Environmental Education (EE) facilities or staff dedicated to EE. Currently the refuge manager provides refuge tours and educational programs upon request. Approximately six to ten programs are provided annually, reaching 150 to 200 students annually. Volunteers currently provide environmental education programs to an additional 250 students annually. While the Refuge relies on a small cadre of dedicated volunteers to run educational and other programs, the size of the volunteer program is currently limited by lack of staff to recruit, train, and manage volunteers.

The Refuge would continue to provide limited opportunities for hunting of migratory game birds (ducks, geese, mergansers, American coots, and Wilson's snipe) and upland game birds (ring-necked pheasants, gray partridge, and sage-grouse) on two separate units totaling approximately 2,510 acres. Big game hunting is not allowed.

Visitor information would continue to be disseminated through a self-serve informational kiosk collocated with an adjoining comfort station and paved parking area. There is a small visitor contact area in the refuge office that is staffed on weekdays during normal business hours when employees are available.

Alternative 2: Increase Variability of Wetland Habitats; Increase Wildlife-dependent Recreation Opportunities (Preliminary Preferred Alternative)

Wildlife and Habitat:

The Refuge would provide a more diverse array of wetland, riparian, and upland habitats for not only waterfowl, but a variety of migratory birds and other wildlife.

Over the next four years, as the Refuge develops a wetland and riparian rehabilitation plan (see below), wetlands would be managed in a more dynamic nature. Of the six refuge wetland impoundments, no more than three to four would be annually deep flooded for hemi-marsh habitat, with two to three impoundments annually drawn-down dry, and one to two impoundments managed as seasonally flooded shallow marsh habitat. This would simultaneously provide more natural variability in wetland habitats, while reducing the Refuge's dependency upon groundwater pumping.

Using the results of site-specific assessments, hydrogeomorphic (HGM) modeling, and pilot projects, the Refuge would develop a long-term rehabilitation plan for Camas Creek and refuge wetlands (Wetland and Riparian Rehabilitation Plan) by 2017. Under this plan, water would be managed to mimic natural variability in hydrologic processes, while simultaneously conserving groundwater resources and rehabilitating partial riparian habitat function. An engineering feasibility study, using the results of HGM modeling (scheduled for completion in the next two years) would be used to determine the best engineering solution to achieve this goal. Using the results of these studies, wetland management and infrastructure (e.g., dikes, levees, ditches) would be removed, modified, or relocated to restore, where possible, the partial historic extent of some shallow marsh and wet meadow habitats. New diversion structures and additional points of diversion would be constructed to increase the efficacy of water delivery. This infrastructure would only partially deflect Camas Creek flows into managed wetland areas, while simultaneously allowing partial flow to remain in the Camas Creek channel. As in Alternative 1, groundwater pumping would still be used to compensate for losses of surface water to groundwater seepage. However, supplemental pumping efforts would attempt to mimic shallower seasonal wetlands, rather than an expansive deep hemi-marsh.

The goal of Camas Creek restoration would be a partial reinstatement of historic habitat function, including increased frequency, duration and extent of overbank flows. Under this alternative, assessments and pilot projects necessary to develop the Wetland and Riparian Rehabilitation Plan would be completed as funding, staff time, and resources allow. The Service would consult with a large range of riparian experts, evaluate an array of possible enhancement scenarios, and use results of pilot projects to develop the Plan. Immediate actions within four years of CCP completion may include a pilot project to partially lower the bank berms of Camas Creek in strategic locations. In average or abundant water years, the Refuge would balance Camas Creek diversions between wetland and riparian management needs to ensure partial riparian flow and function below the refuge diversion points.

Inventory and monitoring efforts would place high priority on information that assists the Refuge in building a baseline data layer that could be used in pursuing riparian rehabilitation activities while furthering our understanding of adjacent habitats. More in-depth, site-specific assessments would be done if opportunities arise (e.g., funding availability and additional refuge staff).

Efforts to stabilize and rehabilitate upland habitats (sage-steppe and native grassland) would increase, but this would be lower priority and subordinate to the primary refuge emphasis on wetland management. The Refuge would not dismiss opportunities for large-scale efforts (described in Alternative 3) to restore habitat connectivity, function, and processes, but wetland and riparian rehabilitation would remain the management priority. Therefore large-scale upland habitat management would occur only as additional funding and time allows. Upland rehabilitation in this Alternative would be similar to Alternative 1 in scope and acreage, but in addition, small test plot (<1 acre) experimental restorations of sagebrush habitat components would be implemented in areas dominated by crested wheatgrass.

Similar to Alternative 1, the headquarters shelterbelt habitat would be managed for tall mature naturalized cottonwoods and for native trees and shrubs within the understory. However, the Refuge would not initiate replacement of tall mature cottonwood trees or native understory trees and shrubs until additional supplemental funding sources were secured. Native tree plantings would be irrigated by renewable energy drip irrigation in the same location where current groundwater irrigation capabilities exist.

Farming would predominately continue on the Refuge as characterized in Alternative 1, with the Refuge farming 160 acres within the Well #7 field (80 acres of which 20 are small grain and 60 acres alfalfa) and the Well #9 field (80 acres of irrigated alfalfa). The Refuge would continue to use cooperative farming agreements with area farmers to plant agricultural fields using refuge-owned irrigation equipment (Well #7 Field) and privately owned irrigation equipment (Well #9 Field). Agriculture fields would be rotated after two consecutive years of cropping small grains into a six-year alfalfa planting. Should the current cooperative farmer decide to no longer farm the Refuge and remove his irrigation equipment, the Refuge would attempt to purchase irrigation equipment and continue to cooperatively irrigate and farm the Well #9 Field. Should the Refuge be unable to acquire irrigation equipment, the Alternative 2 contingency is to implement rotational dryland farming practices on the Well #9 Field for 20 to 40 acres of dryland grain and 20 to 40 acres of dryland alfalfa. Approximately 45 percent (150 acres) of formerly farmed fields would be irrigated and hayed annually.

Public Use:

The Refuge would expand quality wildlife observation and photography opportunities. The existing ½ mile shelterbelt birding trail would be lengthened to 1.3 miles and the existing viewing platform within Camas Creek riparian habitat would be maintained. The use of personal portable photo blinds would be allowed on the Refuge within 100 feet of refuge roads or trails.

As in Alternative 1, a 6.3-mile auto tour route would be maintained year round; however the route would be changed from two-way to one-way. 6.5 miles of refuge roads (leading to the north and south waterfowl and upland game hunting units) would be open to vehicle and pedestrian access during hunt seasons. No additional refuge roads would be open to vehicle traffic. Year-round hiking, biking, jogging, cross-country skiing, or snowshoeing would be allowed on approximately 27 miles of unmaintained and ungroomed refuge service roads as conditions permit. To avoid disturbances to wildlife and their habitat, off-road hiking would be prohibited, except by hunters with valid State licenses in the hunt areas during State seasons. Dog walking would be allowed only on roads that are open to public use, and dogs would be required to be on a leash or functional electronic collar at all times. As in Alternative 1, horseback riding would be prohibited.

A small visitor contact station, environmental education multi-purpose room, and refuge office would be constructed. One new full-time position stationed at Camas NWR would be dedicated to the expansion of the Refuge's Environmental Education program. A new Visitor Services Manager position, stationed at the SE Idaho Complex office, would be created to recruit, train, and oversee volunteers, allowing the volunteer program to expand. With these additional facilities, staffing, and volunteers, the Refuge would serve up to 800 students annually within ten years, and offer volunteer-led tours to an additional 200-300 visitors annually.

Opportunities for migratory game bird and upland game bird hunting are the same as in Alternative 1. The Refuge would allow hunting of elk on 4,112 acres by issuing up to 20 elk hunting access permits annually. Priority would be given to youth and mobility impaired hunters. The permit system would allow us to provide a safe, quality, and uncrowded hunt that assists IDFG in reducing elk depredation on nearby agricultural lands and reduces the potential for elk damage to the Refuge's riparian habitat.

Alternative 3: Increase Variability of Wetland Habitats; Restore Upland Habitats; Increase Wildlife-dependent Recreation Opportunities:

Wildlife and Habitat:

The Refuge would provide a more diverse array of wetland, riparian, and upland habitats for not only waterfowl, but a variety of migratory birds and other wildlife. Wetland and riparian management, including short-term changes to management of wetland impoundments, and a long-term rehabilitation plan for Camas Creek and refuge wetlands, would occur as described in Alternative 2.

Similar to Alternative 2, inventory and monitoring efforts would place high priority on collecting data needed to implement riparian rehabilitation activities.

In Alternative 3, upland (sage-steppe and native grassland), wetland, and riparian habitats would receive equal management emphasis. Actions described in Alternatives 1 and 2 for wetland and riparian habitats would continue. As in Alternative 2, the Refuge would develop a long-term rehabilitation plan for Camas Creek and refuge wetlands (Wetland and Riparian Rehabilitation Plan) by 2017. In addition, the Refuge would emphasize restoring landscape connectivity within sagebrush ecosystems to support and maintain integrated wildlife communities. Upland management would strongly emphasize maintaining and restoring structural and functional attributes of sage-steppe habitat. Thus the best results would come from matching management questions to a mix of technologies and methods based on the scale of the question. Inventory and monitoring efforts in this Alternative would also assess sage-steppe habitat and wildlife attributes at multiple scales.

Existing naturalized shelterbelt habitat would continue to be maintained to provide habitat for migratory landbirds and maintain quality wildlife viewing opportunities. Over time, non-native trees and shrubs would be replaced with native trees and shrubs that provide similar habitat attributes. Cottonwoods would continue to be irrigated within the refuge shelterbelt habitat to reduce mortality of mature trees. Replacement cottonwoods and native understory trees and shrubs would be planted in existing stands as mature trees and shrubs die off. The Refuge would seek outside funding sources to maintain existing shelterbelt habitat and expand this habitat on the periphery of the existing stand, adjacent to current irrigation infrastructure.

Within the next eight years, acres of cooperative farming on the Refuge would decrease from 160 acres to 80 acres (60 of irrigated alfalfa and 20 acres of irrigated small grain) for use by waterfowl, cranes, upland game birds and big game species that inhabit the Refuge. Eighty acres of farmland would be slowly restored back to a native sage-steppe community. This would be accomplished by restoring 20 acres every two years until all 80 acres are returned to a native plant community. As in Alternative 2, agriculture fields would be rotated after two consecutive years of cropping small grains into a six-year alfalfa planting.

The Refuge’s 330 acres of formerly farmed fields would no longer be irrigated. Haying would occur on up to 150 acres of dryland meadows annually, without irrigation.

Public Use:

The Refuge would expand quality wildlife observation and photography opportunities. As in Alternative 2, the existing ½ mile shelterbelt birding trail would be expanded to 1.3 miles and the existing viewing platform within Camas Creek riparian habitat would continue to be maintained. As in Alternative 2, the use of personal portable photo blinds would be allowed on the Refuge within 100 feet of refuge roads or trails. In addition, three new semipermanent photo blinds would be established with input from local photographers. Blinds would be available by reservation.

As in Alternative 2, a 6.3-mile, one-way auto tour route would be maintained year round, and 6.5 miles of refuge roads (leading to the north and south waterfowl and upland game hunting units) would be open to vehicle and pedestrian access during hunt seasons. In addition, the Refuge would open the 7.5 mile Sandhole Lake loop road seasonally (July 1-Nov 1) for vehicle traffic. Year-round hiking, biking, jogging, cross-country skiing, or snowshoeing would be allowed on approximately 27 miles of unmaintained and ungroomed refuge service roads as conditions permit. Ten miles of these service roads would be groomed in winter. Off-road hiking would be allowed year round on the north waterfowl and upland game hunting unit (980 acres), and January 1-July 31 in the south waterfowl and upland game hunting unit (1,530 acres). Off-road hiking would be prohibited on the rest of the Refuge to avoid disturbances to wildlife and their habitat. As in Alternative 2, dog walking would be allowed only on roads that are open to public use, and dogs would be required to be on a leash or functional electronic collar at all times. As in Alternatives 1 and 3, horseback riding would be prohibited.

A new visitor contact station would be constructed with environmental education multi-purpose room and a new refuge office. The visitor contact station would be staffed during peak wildlife viewing seasons or special events by volunteers and/or the Friends Group of Camas NWR. Two new positions would be created to advance environmental education and volunteer programs on the Refuge. As in Alternative 2, the new Environmental Education position would be stationed at Camas NWR. The additional Volunteer Coordinator position would be stationed at the Southeast Idaho NWR Complex in Pocatello Idaho. With additional staff and facilities the Refuge could serve up to 2,000 students annually within ten years, and offer volunteer-led tours to an additional 400 visitors annually.

Opportunities for migratory game bird and upland game bird hunting are the same as in Alternative 1. As in Alternative 2, the Refuge would allow hunting of elk on 4,112 acres by issuing up to 20 elk hunting access permits annually. Priority would be given to youth and mobility impaired hunters. The permit system would allow us to provide a safe, quality and uncrowded hunt that assists IDFG in reducing elk depredation on nearby agricultural lands and reduces the potential for elk damage to the Refuge's riparian habitat.

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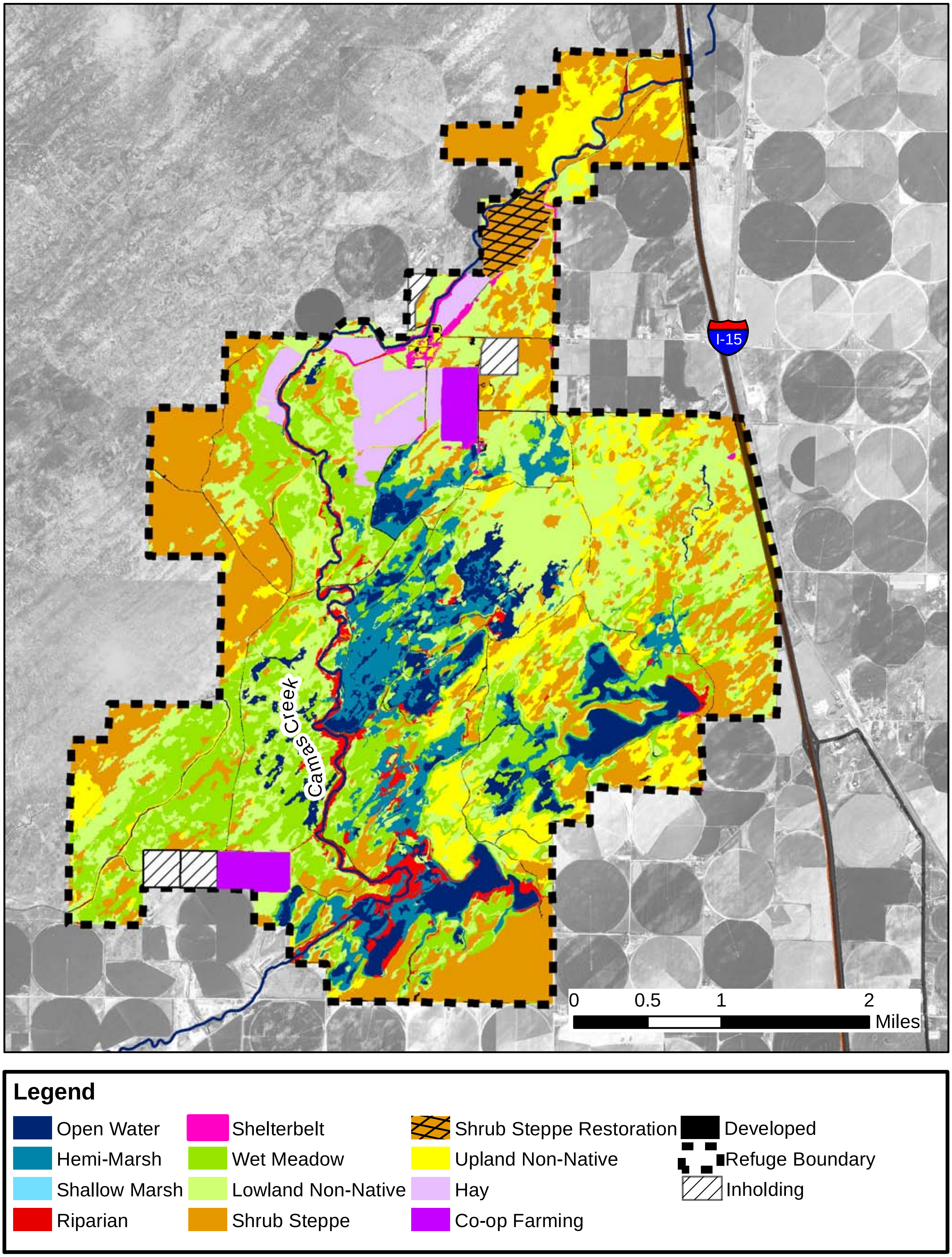
Map 3. **Habitats, Alternative 1, Current Management**



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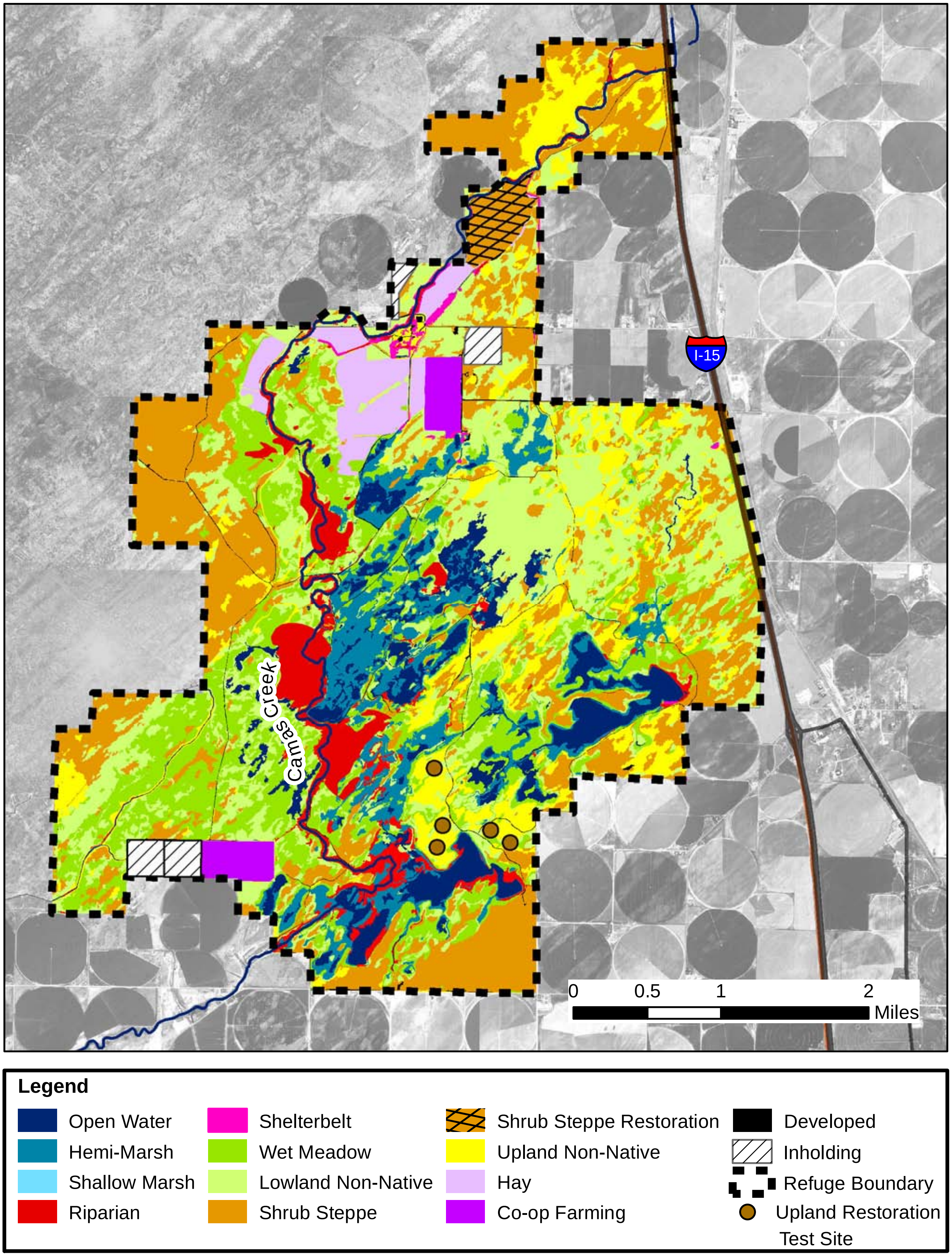
Map 4. ***Habitats, Alternative 2, Preferred Alternative***



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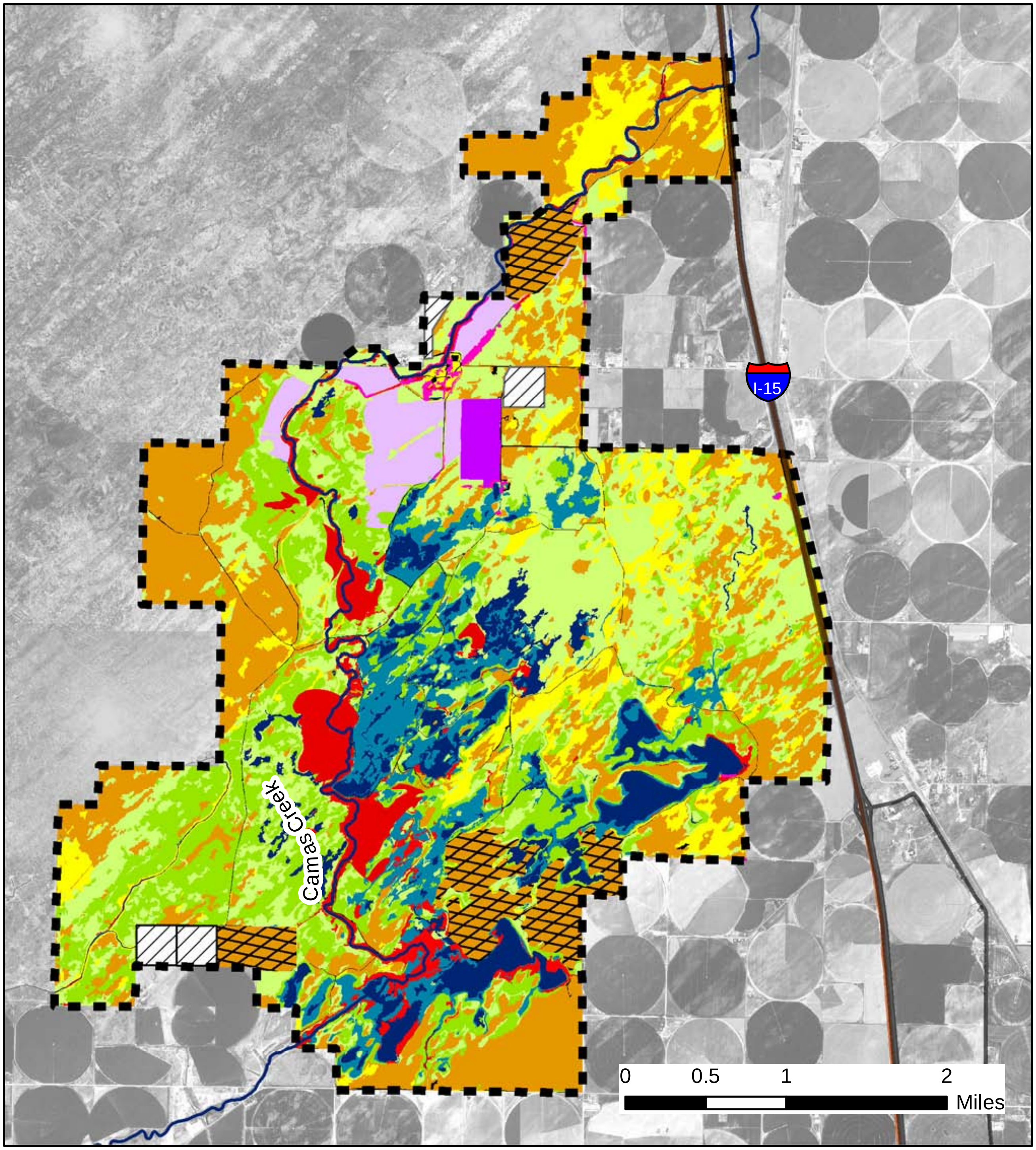
Map 5. ***Habitats, Alternative 3***



Legend

Open Water	Shelterbelt	Shrub Steppe Restoration	Developed
Hemi-Marsh	Wet Meadow	Upland Non-Native	Refuge Boundary
Shallow Marsh	Lowland Non-Native	Hay	Inholding
Riparian	Shrub Steppe	Co-op Farming	

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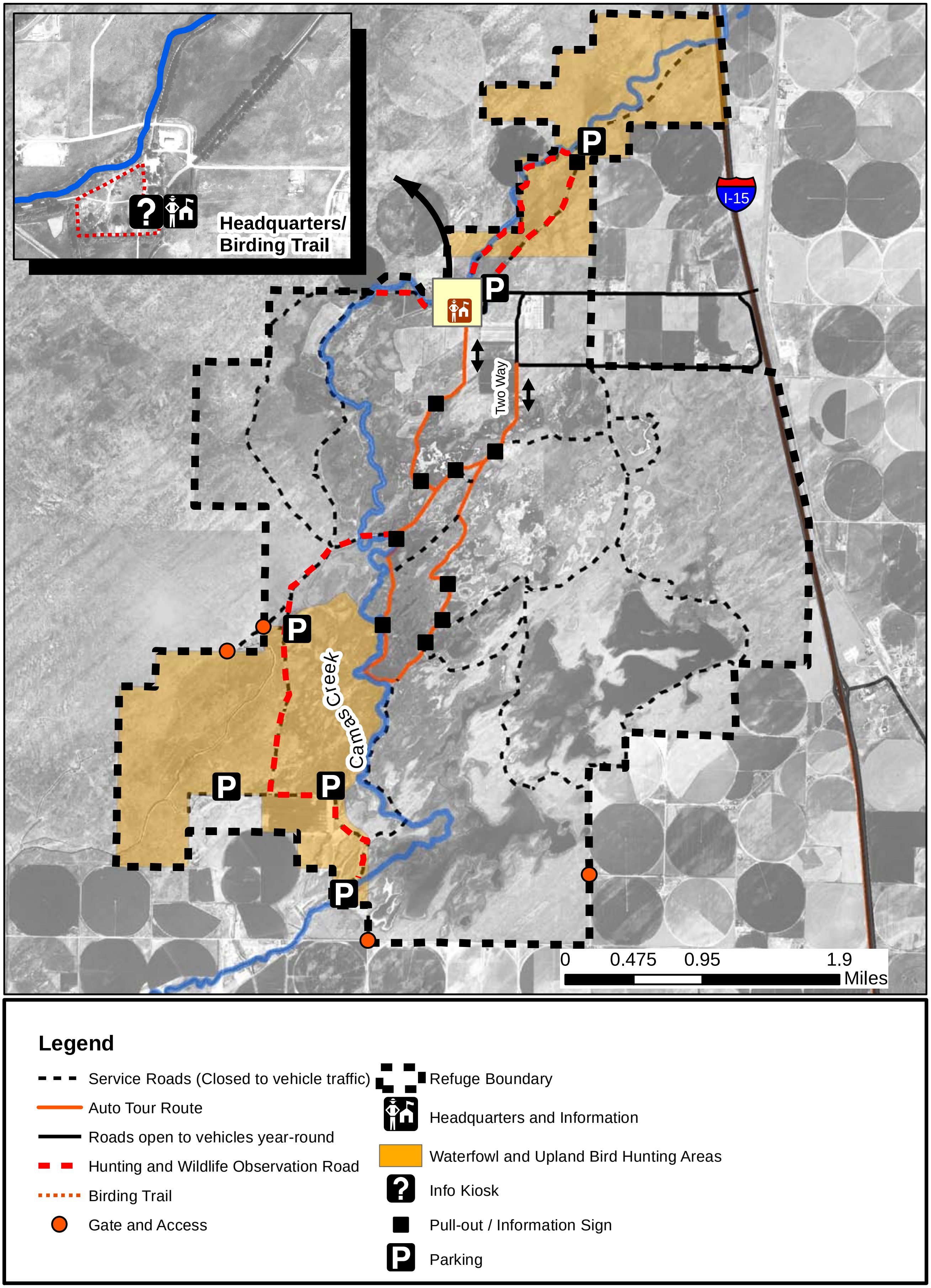
Map 6. **Public Use, Alternative 1, Current Management**



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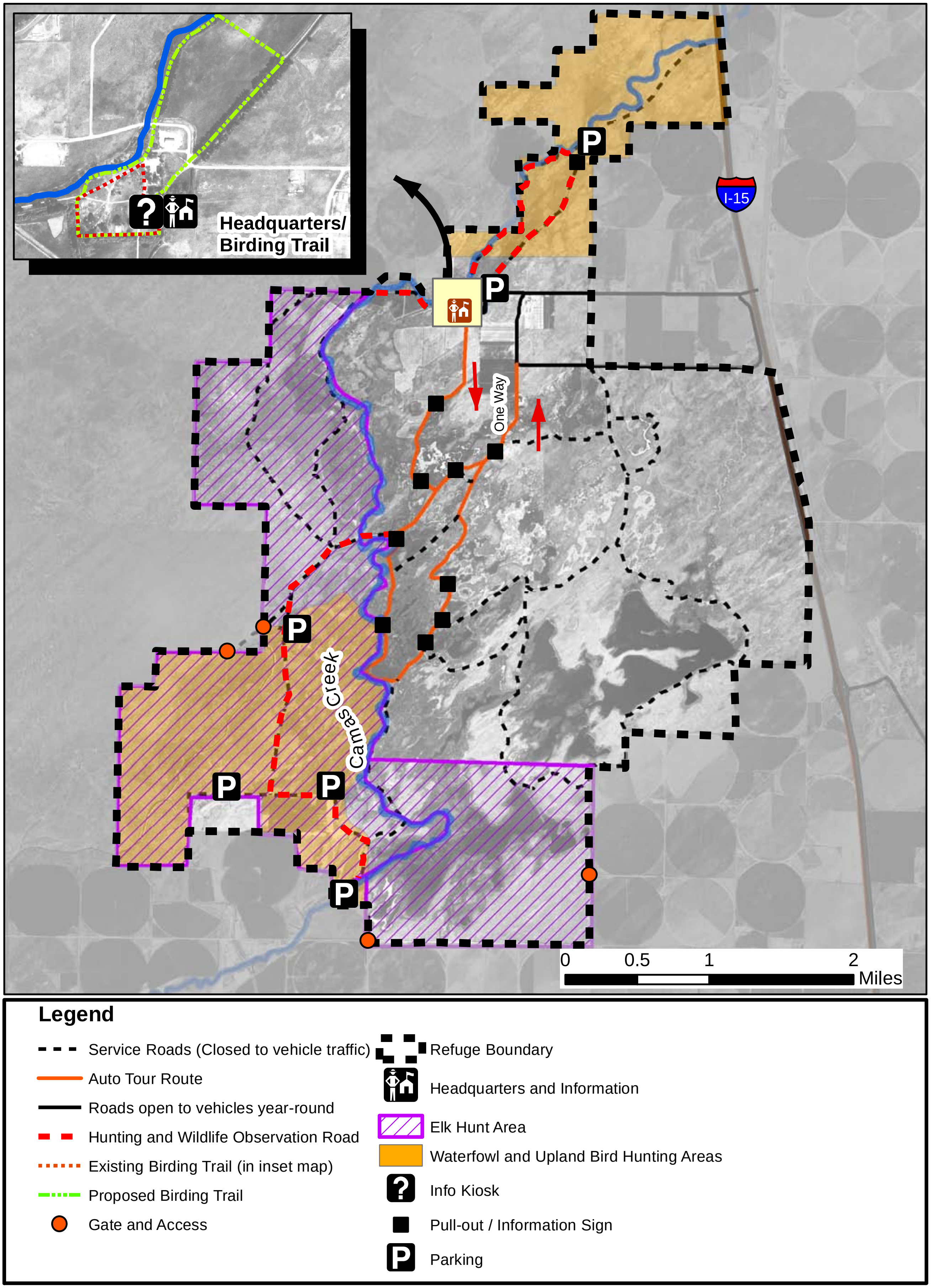
Map 7. **Public Use, Alternative 2, Preferred Alternative**



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Map 8. **Public Use, Alternative 3**

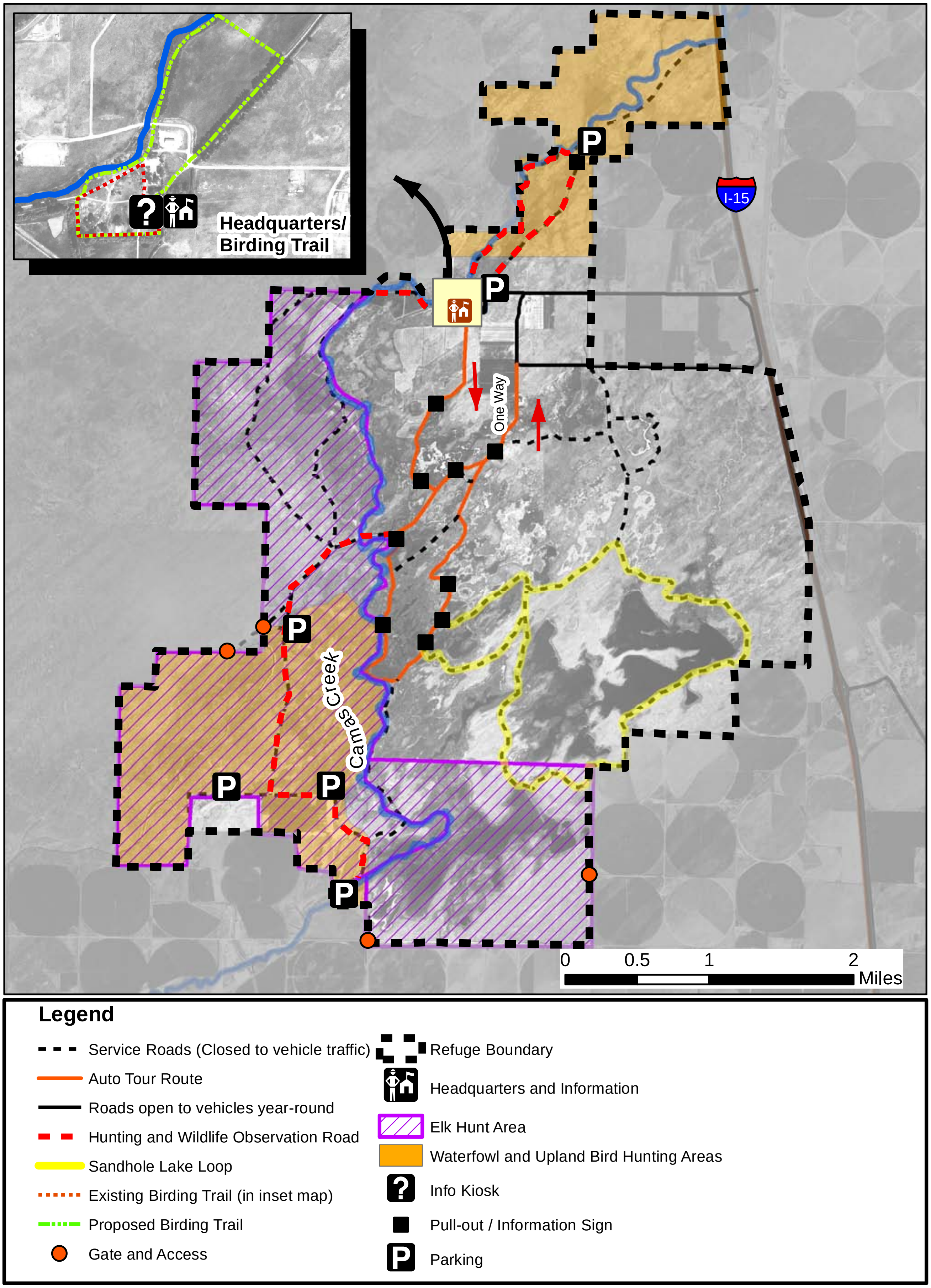

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Table 2.1. Comparison and Summary of Management Alternatives

	Alternative 1 (No-Action Alternative)	Alternative 2 (Preferred Alternative)	Alternative 3
Alternative Theme	**Provide Breeding Habitat; Prioritize Non-Consumptive Wildlife-dependent Recreation**	**Increase Variability of Wetland Habitats; Increase Wildlife-dependent Recreation Opportunities**	**Increase Variability of Wetland Habitats; Restore Upland Habitats; Increase Wildlife-dependent Recreation Opportunities**
NATIVE WETLAND HABITAT MANAGEMENT			
ALL WETLANDS		From 2014-2017 develop Wetland and Riparian Rehabilitation Plan to re-establish dynamic wetlands and sustainable fluvial riparian system 1. 2014-2015: Assess hydrologic, geomorphic, and biologic features associated with target wetland systems 2. 2014-2017: Implement wetland pilot projects to evaluate biological and physical responses to management 3. By 2017: Develop a decision support system to identify management objectives to rehabilitate wetland habitats	
HEMI-MARSH	For the life of the plan: a) Maintain 840 acres annually b) Manage deep-flooded Hemi-Marsh in 6 wetland basins (783 acres) annually c) Draw-down 0 wetland basins annually	For the next 4 years (2014-2017): a) Decrease to 285 acres (range: 250-300 acres) annually b) Manage deep-flooded Hemi-marsh in 3-4 wetland basins annually c) Draw-down 2-3 wetland basins annually	
SHALLOW MARSH	For the life of the plan, maintain 1,213 acres of seasonal and semipermanent wetlands in managed wetland basins.	For the life of the plan, maintain 1,743-1,803 acres of seasonal and semipermanent wetlands in managed wetland basins.	

	Alternative 1 (No-Action Alternative)	Alternative 2 (Preferred Alternative)	Alternative 3
SEASONALLY FLOODED SHALLOW MARSH (MOIST SOIL)	For the life of the plan, maintain 40-60 acres in 2 wetland basins annually	For the next 4 years (2014-2017), increase to 150-200 acres in 1-2 wetland basins annually	
WET MEADOW	For the life of the plan, maintain 1,958 acres of existing wet meadow habitat.		
	For the life of the plan, enhance 60-70 acres	For the next 4 years (2014-2017), enhance 80-100 acres	
WILLOW SHRUBLAND	For the life of the plan, maintain and enhance 239-259 acres of willow shrubland associated with refuge wetlands (e.g., Rays Lake, Sandhole Lake).		
RIPARIAN CAMAS CREEK (IN-STREAM AND WILLOW RIPARIAN)	For the life of the plan: a) Maintain 4 miles in-stream habitat b) Maintain 20-40 acres of willow riparian habitat associated with Camas Creek.	For the next 4 years (2014-2017): a) Maintain and restore 8 miles in-stream habitat b) Maintain and restore 100-150 acres of willow riparian habitat associated with Camas Creek.	
	Divert 58.1 cfs through 1 point-of-diversion on Camas Creek for impounded wetland habitat	Between 2014 and 2017 implement pilot project to lower the banks of Camas Creek in strategic locations to restore more natural and efficient wetland hydrology.	
NATIVE UPLAND HABITAT MANAGEMENT			
SHRUB STEPPE (SAGEBRUSH)	For the lifetime of the plan, maintain 2,623 acres of existing sagebrush-steppe habitat.		
	Rehabilitate and restore 113 acres of degraded or altered sagebrush steppe habitat		Rehabilitate and restore 425 acres
	Maintain rehabilitation and restoration efforts as a subordinate priority to wetland management	Slightly increase rehabilitation and restoration efforts as a subordinate priority to wetland management	Dramatically increase rehabilitation and restoration efforts as a co-equal priority to wetland management

	Alternative 1 (No-Action Alternative)	Alternative 2 (Preferred Alternative)	Alternative 3
		Increase diversity and habitat function within altered crested wheatgrass habitats	Increase ecological integrity within the Upper Snake Ecoregion
NATURALIZED HABITAT MANAGEMENT			
SHELTERBELT	Maintain 34 acres in current location		Expand to 50 acres along the periphery of existing habitat
	Groundwater irrigation Use refuge base funding for shelterbelt management	Partial groundwater and micro-irrigation Develop supplemental funding to support shelterbelt management	Groundwater irrigation Use refuge base funding for shelterbelt management
AGRICULTURAL HABITAT MANAGEMENT			
WELL #7 FIELD (SMALL GRAIN AND ALFALFA)	Use Cooperative Land Management Agreements (CLMA) with local farmers and refuge irrigation equipment to farm: Total 80 acres Grain: 20 acres (irrigated) Alfalfa: 60 acres (irrigated)		
	Rotate irrigated grain crop with alfalfa (2 years grain/6 years alfalfa) in Well #7 field		
WELL #9 FIELD (ALFALFA AND RESTORATION)	Use Cooperative Land Management Agreement (CLMA) with local farmers and privately owned irrigation equipment to farm: Total 80 acres Alfalfa: 80 acres (irrigated)		Restore Well #9 Field to native shrub steppe habitat, 20 acres every two years, until all 80 acres completed.
		Implement rotational dryland farming practices, should Refuge be unable to acquire irrigation equipment. Grain: 20-40 acres (dryland) Alfalfa: 20-40 acres (dryland)	
HAY	Irrigate 330 acres (100%) of formerly farmed fields annually.	Irrigate 150 acres (45%) of formerly farmed fields annually.	Do not irrigate formerly farmed fields.

	Alternative 1 (No-Action Alternative)	Alternative 2 (Preferred Alternative)	Alternative 3
	Hay 150 irrigated acres annually		Hay up to 150 dryland acres annually.
LAND PROTECTION AND CONSERVATION (ALL ALTERNATIVES)			
PRELIMINARY PROJECT PROPOSAL	Develop Preliminary Project Proposal (PPP) within 3 years of CCP completion		
LANDSCAPE PROTECTION PLAN	Upon PPP approval, develop an LPP to address land protection alternatives and prioritize adjoining lands that are most critical for protection of refuge water quality and quantity; have the highest quality sage-steppe and wetland habitat; and provide the best opportunities for habitat restoration.		
INVASIVE SPECIES CONTROL (ALL ALTERNATIVES)			
INVASIVE SPECIES CONTROL	Continue to control State-listed noxious weeds and non-noxious weeds (e.g., common mullein, common teasel, horseweed, and tumble mustard) to the degree that funding permits.		
FIRE MANAGEMENT (ALL ALTERNATIVES)			
FIRE SUPPRESSION AND FUELS MANAGEMENT	Consider a full range of appropriate suppression strategies and conduct prescribed fires for hazardous fuels and habitat management.		
EMERGENCY STABILIZATION AND REHABILITATION	Implement emergency stabilization and burned area rehabilitation, which also includes suppression activity, damage repair, and long-term (>3 years) restoration, as part of a holistic approach to addressing post wildfire issues.		
WATER RESOURCES (ALL ALTERNATIVES)			
WATER RIGHTS	Obtain water supplies of adequate quantity and quality, and the legal rights to use that water, for development, use, and management of Service lands and facilities, and for other congressionally authorized objectives such as protection of endangered species and maintenance of instream flows.		
IN-STREAM OBSTRUCTIONS	Accommodate downstream water users for the removal of in-stream obstructions in Camas Creek, as per the conditions of the Mud Lake Water Decree.		

	Alternative 1 (No-Action Alternative)	Alternative 2 (Preferred Alternative)	Alternative 3
INVENTORY, MONITORING, SCIENTIFIC ASSESSMENTS, AND RESEARCH			
INVENTORY AND MONITORING STEP DOWN PLAN		Conduct interim (2014-2015) I&M objectives for: • Prioritized baseline inventories of vegetation and wildlife • Adaptive management at refuge and landscape scales • Prioritized surveys of wildlife and habitats for focal or rare species or species groups • Recruiting qualified researchers and funding to conduct high-priority research projects.	
	Develop Inventory and Monitoring step down plan for Camas NWR by 2016. The Refuge I&M Plan would consist of 3 components: 1. A prioritized list of surveys and methods for the Refuge. 2. A justification regarding how each survey informs refuge resource management decisions. 3. A time frame (calendar) to complete training, fieldwork, data management and analyses, and reporting for each survey.		
WELCOME AND ORIENT VISITORS			
WELCOME AND ORIENTATION	Provide self-service orientation facilities and a comfort station for visitors.		
	Provide small visitor contact area in refuge office.	Construct new visitor contact station and environmental education multi-purpose room staffed by Friends of Camas NWR volunteers.	
		Create an on-site Visitor Services staff position (Park Ranger) to develop and deliver outreach and visitor services programs.	
WILDLIFE OBSERVATION AND WILDLIFE/NATURE PHOTOGRAPHY			
TOUR OPPORTUNITIES	Self-guided only	Self-guided and refuge volunteer–led tours	
AUTO TOUR ROUTE AND VEHICULAR ACCESS	6.3 mile year-long, two-way auto tour route with pullouts, interpretive panels	6.3 mile year-long, one-way auto tour route with pullouts and interpretive panels	
	6.5 miles of roads open to vehicle and pedestrian access during hunt seasons (Roads leading to and within the north and south migratory game bird/upland game bird hunt units)		14 miles of seasonally open roads (Re-open 7.5 mile Sandhole Lake loop road, July 1-Nov 1 in addition to the 6.5 seasonally open in Alternatives 1 and 2)

	Alternative 1 (No-Action Alternative)	Alternative 2 (Preferred Alternative)	Alternative 3
Birding Trail	0.5 mile	1.3 mile	
Trails (Walking, Bicycling, Cross-Country Skiing, Snowshoeing)	27 miles of service roads open year round to hiking, jogging, bicycling, cross-country skiing, and snowshoeing, weather and conditions permitting		
	Unmaintained and Ungroomed		17 miles Unmaintained 10 miles Groomed (For Cross-country Skiing)
Off-Road Hiking	Allowed July 15-February 28 10,806 acres (entire Refuge)	Off-road hiking prohibited, except by hunters with valid State licenses in hunt areas, during hunt seasons	*As in Alternative 2, except*: Off-road hiking allowed year round on 980 acres (north waterfowl/upland game hunt unit); Jan 1-July 31 in the south waterfowl and upland game hunting unit (1,530 acres)
Elevated Viewing Platforms	1 wildlife observation platform at Camas Creek, near refuge HQ		
Photography Blinds	No blinds	Up to 5 personal portable blinds for photography would be allowed on the Refuge at any given time. Blinds must be placed within 100 feet of a refuge road.	*As in Alternative 2, but in addition*: 3 semipermanent photo blinds available by reservation
Guided Wildlife Viewing Tours	No tours	8 tours annually	12 tours annually
Environmental Education and Interpretation			
Members Of Public Reached Annually	400-500	1,000-1,000	2,000-2,400

<table>
<tr><th></th><th>Alternative 1
(No-Action Alternative)</th><th>Alternative 2
(Preferred Alternative)</th><th>Alternative 3</th></tr>
<tr><td>Students in EE Programs Annually</td><td>250 students</td><td>800 students within first 10 years of facility development</td><td>2,000 students within first 10 years of facility development</td></tr>
<tr><td>Wildlife Based Educational Tours</td><td>6-10 Tours
Refuge staff led
150-200 Participants</td><td>10-15 Tours
Refuge staff and volunteer led
200-300 Participants</td><td>20 Tours
Refuge staff and volunteer led
400 Participants</td></tr>
<tr><td rowspan="2">Staffing</td><td>No staff dedicated to public use, environmental education</td><td colspan="2">Staff 1 full-time Camas NWR Park Ranger position
Coordinate program and develop refuge-specific curricula</td></tr>
<tr><td>Refuge manager recruits, coordinates, trains volunteers (limited capacity)</td><td colspan="2">Staff full-time Southeast NWRC Volunteer Coordinator position
Oversee recruitment and training of refuge volunteers</td></tr>
<tr><td>Facilities</td><td>No facilities dedicated to EE.</td><td colspan="2">Construct a combined refuge office, small visitor contact station, and environmental education multi-purpose classroom.</td></tr>
<tr><td colspan="4">Hunting</td></tr>
<tr><td rowspan="2">Hunt Type/Acres</td><td colspan="3">Waterfowl, upland game hunting allowed on 2,510 acres in accordance with State seasons and regulations.</td></tr>
<tr><td>No big game hunting</td><td colspan="2">Allow elk hunting on 4,112 acres; 0 to 20 access permits issued annually with priority to mobility impaired and youth hunters.</td></tr>
<tr><td colspan="4">Friends Group and Volunteers</td></tr>
<tr><td>Friends of Camas NWR</td><td colspan="3">Assist Friends of Camas NWR grow its membership and build a strong, actively engaged workforce that supports the Refuge’s biological and visitor service programs.</td></tr>
<tr><td>Projects</td><td colspan="3">Develop a list of educational and biological projects and activities to assist the Friends Group in focusing and prioritizing their efforts.</td></tr>
<tr><td>Staffing</td><td>Refuge Manager recruits, coordinates, trains volunteers (limited capacity)</td><td colspan="2">Staff full-time Visitor Service Manager position for the Southeast Idaho NWRC Office in Pocatello, ID
Hire a Camas NWR Park Ranger to assist with recruiting, assisting, and training the Refuge’s Friends Group and volunteer workforce.</td></tr>
</table>

	Alternative 1 (No-Action Alternative)	Alternative 2 (Preferred Alternative)	Alternative 3
LAW ENFORCEMENT (ALL ALTERNATIVES)			
STAFFING	Refuge Complex Officer staffed in Southeast Idaho NWRC Office Pocatello, ID Zone Officer staffed at Deer Flat NWR, Nampa, ID Special Agent staffed in Office of Law Enforcement Idaho, Falls, ID		
PARTNERSHIPS	Create and foster partnerships with the County Sheriff, IDFG, BLM, Tribal, and FS Law Enforcement to provide mutual aid benefits.		
CULTURAL RESOURCES (ALL ALTERNATIVES)			
INVENTORY	Inventory, evaluate, monitor, and protect refuge cultural resources.		
TRIBAL CONSULTATION	Coordinate and Consult with the Shoshone-Bannock Tribes on cultural resources identification and protection.		
PUBLIC AWARENESS	Increase public awareness and appreciation of the Refuge's historic, archaeological, and cultural resources using signs, brochures, and other appropriate information and educational tools.		
INTERPRET CULTURAL RESOURCES	Partner with Tribes, universities, Friends groups, and volunteers to provide cultural resources interpretation and education programs and exhibits for refuge visitors and Tribal members.		
HISTORIC STRUCTURES	To the fullest extent possible, maintain the structural integrity of the historic structures that were built during the Works Progress Administration (WPA) days, with regular inspections and updates when necessary.		

2.4 Goals, Objectives, and Strategies

Goals and objectives are the unifying elements of successful refuge management. They identify and focus management priorities, resolve issues, and link to refuge purposes, Service policy, and the Refuge System mission.

A CCP describes management actions that 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. 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. Strategies identify specific tools and actions to accomplish objectives (USFWS 2008).

In the development of this Draft CCP, the Service prepared an environmental assessment. The environmental assessment evaluates alternative sets of management actions derived from a variety of management goals, objectives, and implementation strategies.

The draft goals for Camas Refuge for the fifteen years following completion of the CCP are presented on the following pages, in tables. 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 reasonable location. Similarly, some strategies pertain to multiple objectives.

The goal order does **not** imply any priority in this CCP. Priority actions are identified in the staffing and funding analysis (Appendix C).

Readers, please note the following:

- The objective statements apply to the Service's Preferred Alternative, Alternative 2.
- ***Text underlined and italicized*** in the objective statement indicates specific items (i.e., acreages) that vary in the other alternatives. How those items vary is displayed in the short table under each objective statement; as applicable, each other alternative shows substitute text for the item or items in italics.
- If an objective is not in a particular alternative, a blank is used to indicate that this objective is not addressed in that alternative.

Below each objective statement are the strategies that could be employed in order to accomplish the objectives. Note the following:

- Check marks (✓) alongside each strategy show which alternatives include that strategy.
- If a column for a particular alternative does not include a check mark for a listed strategy, it means that strategy will not be used in that alternative.

Other symbols used in the following tables include:

% percent sign
> greater than
< less than
≥ greater than or equal to
≤ less than or equal to

Goal 1: ***Native Habitats***
Maintain and protect the existing integrity of functional native habitat and restore the natural range of variability and resiliency of degraded habitats.

WETLAND HABITATS

Objective 1.1: Hemi-Marsh Habitat Management

From 2014-2017 **decrease hemi-marsh habitat to** ***285 acres (range 250-300 acres)*** **within** ***3-4 annually flooded impoundments*** **and** ***2-3 impoundments annually dewatered (drawn-down)*** **to provide conditions essential for the conservation of select focal wildlife species, while simultaneously working to** ***develop a Wetland and Riparian Rehabilitation Plan by 2017*** **to rehabilitate Camas Creek and refuge wetlands.**

Benefitting Refuge Species:

Redhead, eared grebe, trumpeter swan, muskrat, Franklin's gull, white-faced ibis, lesser scaup, peregrine falcon

Hemi-marsh is characterized by the following attributes

- Native emergent species (hardstem bulrush, burreed, cattails) as a mosaic with open water.
- Permanently to semipermanently flooded, with water depths ranging from 6"-5′
- Inundated from March through October, with drawdowns every 3 to 7 years.
- 25-35% open water to 65-75% of emergent plant cover within individual wetlands
- >40% cover of submergent plants (e.g., pondweeds, chara, water milfoil, coontail, smartweed, mare's tail) within open water areas
- Diverse invertebrate community, including crustaceans, midges, aquatic worms, dragonflies, snails, and water beetles.
- <5% cover of invasive plants (e.g., reed canarygrass)

Alternatives *Objective as written above is modified by replacing acres in italics with the text in this row.*	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Timeframe:	For the life of the plan	From 2014-2017	
Total Hemi-Marsh acres managed:	840 acres (range 500-700 acres)	285 acres (range 250-300 acres)	
Annually flooded impoundments in Hemi-Marsh habitat:	6 basins (783 acres)	3-4 basins (285 acres)	
Annually dewatered (drawn-down) impoundments	0 basins	2-3 basins	
Develop Wetland and Riparian Rehabilitation Plan		By 2017	

Strategies Applied to Achieve Objective	Alt 1 Current	Alt 2 Preferred	Alt 3
Maximize the extent of hemi-marsh in 6 wetland basins (Big, Redhead, Toomey, Center, Two-Way and Spring Ponds) with available annual water delivery and management capabilities from April-October.	✓		
Maintain ≥500 acres of artificially deep hemi-marsh habitats primarily for waterfowl and secondarily to provide wildlife-dependent public use opportunities.	✓		
From 2014-2017 reduce the extent of hemi-marsh to occur within only 3 to 4 of 6 wetland basins (i.e., Big, Redhead, and Toomey Ponds), which historically consisted of natural deep marsh habitat before refuge impoundment construction, and are presumed to have tighter pockets of hydric soils, which historically held permanent water when natural groundwater levels were higher.		✓	✓
Maintain 285 acres (range 250-300 acres) of artificially deep hemi-marsh habitats primarily for fish, wildlife, and plants and secondarily to provide wildlife-dependent public use opportunities until the Wetland and Riparian Rehabilitation Plan is completed in 2017.		✓	✓
From 2014-2017, develop a Wetland and Riparian Rehabilitation Plan (and associated NEPA document) for Camas NWR using a three-tiered process: 1. 2014-2015: Assessment of hydrologic, geomorphic, and biologic features associated with target wetland (i.e., hemi-marsh, shallow marsh, and wet meadow) and riparian (i.e., riparian and riparian woodland) systems; 2. 2014-2017: Implementation of wetland pilot projects to evaluate biological and physical responses to management action and assess management objectives; and 3. 2017: Work with partners to develop a decision support system to identify management objectives and support an integrated approach to rehabilitating wetland and riparian habitats in the Plan.		✓	✓
From 2014-2015, conduct surveys and assessments needed to develop the Wetland and Riparian Rehabilitation Plan: 1. Conduct Hydro Geomorphic Model (HGM) and engineering feasibility study by 2015 to determine historic and current physical refuge setting and best future management options. 2. Perform topographic LiDAR survey and construct a Digital Elevation Model (DEM) of the Refuge by 2015 to quantify elevation gradients natural and altered water flows and location, size, and depth of inundation. 3. Evaluate and compare historic and current wetland habitat extent with GIS data (e.g., soil maps, USGS maps, LandSAT imagery, LiDAR imagery) 4. Quantify winter snowpack and moisture content, spring weather patterns, agricultural acreage and irrigation techniques, groundwater levels, and other appropriate variables that define annual surface and groundwater availability. 5. Assess surface water associations with groundwater discharge and recharge rates by tracing source isotopic signatures.		✓	✓

6. Monitor water delivery ditches and groundwater recharge rates to determine how much Camas Creek surface water or pumped groundwater is lost before the water reaches the intended wetland. 7. By 2015, incorporate HGM classification of natural core wetland extent and develop a water budget and predictive model by 2016 to calculate annual potential water availability and optimize the efficient application of water to achieve native wetland habitat objectives. 8. Run predictive models to determine the anticipated annual location and extent of seasonal wetland habitats to be inundated using annual predictive models of water availability for Camas NWR. 9. Adaptively adjust and recalculate predictive water models based on annual model performance.			
From 2014-2017, construct pilot projects for new diversion structures and additional points-of-diversion to test the capacity to increase the efficacy of water delivery.		✓	✓
Maintain 1 point-of-diversion along Camas Creek for wetland surface water diversion and allow Camas Creek banks to remain raised and diked with minimal overbank flooding.	✓		
Between 2014 and 2017, implement pilot project to lower the banks of Camas Creek on the Refuge in strategic locations, as consistent with Idaho Water Law, to increase the occurrence of natural overbank flooding.		✓	✓
Maximize deep hemi-marsh wetland habitat by diverting the majority of Camas Creek surface waters (58.1 cfs) from April-July in an average flow year to inundate refuge impoundments.	✓		
Upon completion of Wetland and Riparian Rehabilitation Plan in 2017, design a new water delivery system (e.g., wells, canals, pipes, pumps, breaching and/or removal of dikes) to modify, relocate and restore more natural and efficient wetland hydrology, where applicable and desirable.		✓	✓
By 2017, manage deep hemi-marsh wetland habitats to reduce dependency upon groundwater pumping and only partially deflect Camas Creek flows into managed wetland impoundments, while simultaneously allowing partial flow to remain in the Camas Creek channel.		✓	✓
Manage Refuge's Camas Creek surface water rights and refuge groundwater pumping rights to spring flood and maintain permanent to semipermanently flooded wetlands through the summer and fall, for consistent availability of hemi-marsh habitat, but little annual variability in wetland flooding regimes.	✓		
By 2017, manage dynamic wetland rotations within the confines of existing water rights and available annual funding, that provide annual variability which mimics "drought," "normal," or "wet" annual climatic conditions.		✓	✓
Monitor and assess annual climatic variables and use predictive models to assign either "drought", "normal", and "wet" annual wetland management prescriptions by 2017, to ensure water levels occur in refuge wetlands at different heights so no one wetland is maintained at the same water level for prolonged (>3 year) periods.		✓	✓

Every 3 years assess emergent cover using aerial photography, ground-truthing, and GIS analysis to determine responses to habitat management practices.		✓	✓
Use groundwater water rights and pumping to compensate for losses of wetland surface water to groundwater seepage and recharge.	✓		
Manage water within refuge impoundments to maintain marsh productivity and offset the effects of groundwater recharge and evapotranspiration.		✓	✓
Initiate complete drawdowns of deep marsh habitats every 5-7 years to recycle nutrients, increase submerged aquatic germination, and allow for physical control of dense emergent vegetation, as warranted.	✓	✓	✓
Where possible, lessen emergent components of hemi-marsh distribution and density through occasional high water level manipulations (“wet” flooding cycle) to over-winter flood 24"-30" by late January through spring.		✓	✓
Manage low water levels (“drought” flooding cycle) to encourage hardstem bulrush growth, increase bulrush stem density, and decrease open water interspersion, where required and desired.	✓	✓	✓
Use spring (March 1-April 15) or fall (Sept. 20-Oct. 30) prescribed fire and fall mowing to reduce cover of emergents in order to set back succession and maintain open, shallow water areas and create mosaic patterns within wetlands when water level manipulations prove insufficient to maintain hemi-marsh attributes (25-35% open water to 65-75% ratio of emergent plant cover across wetland).	✓	✓	✓
As part of the Refuge’s revised Fire Management Plan, adjust timing of prescribed fire to improve efficacy (e.g. no burns in March; consider summer burns if water can be delivered to wetlands immediately post-burn).		✓	✓
Where mechanical manipulation is not feasible to achieve desired habitat conditions, use approved over-water chemicals to reduce cover of emergents in order to set back succession and maintain open, shallow water areas and create mosaic patterns within wetlands when water levels manipulations are insufficient to maintain Hemi-marsh at 25-35% open water to 65-75% ratio of emergent plant cover across all management units.		✓	✓
Annually maintain and repair water pumps, control structures, and ditches.	✓	✓	✓
Annually document all water level manipulations and hydroperiod.	✓	✓	✓
Annually document all habitat manipulations.	✓	✓	✓
Use IPM strategies including mechanical, physical, biological, and chemical means to eradicate, control, or contain invasive and undesirable plants (see Appendix F-IPM Program).	✓	✓	✓

Rationale, Objective 1.1, Hemi-Marsh Habitat Management:

Most of Camas NWR's deepwater wetlands were created by artesian groundwater discharges that increased due to subirrigation of the Egin Bench starting in the late 1800s (see Chapter 3). Sandhole Lake and Rays Lake represent areas of natural artesian discharge prior to subirrigation (Keigley 2012). The Refuge's water control infrastructure and wetland impoundments were constructed between the 1930s and 1960s to provide waterfowl habitat through precise manipulation of water levels. The Refuge has six "core" wetlands (Big, Redhead, Toomey, Spring, Center, and Two-Way Ponds) that are currently managed to provide consistent hemi-marsh habitat for brood rearing (see Chapter 4). From the time of Refuge establishment until the 1980s, these wetlands were flooded with water diverted from Camas Creek.

The hemi-marsh stage provides diverse food resources and vegetative structure that are used by a variety of wetland-dependent wildlife. During spring and fall migration, refuge hemi-marshes provide exceptional resting and stop-over sites for large flocks of waterfowl. Overwater nesting waterbirds (diving ducks and grebes, for example) require hemi-marsh habitat to fulfill two primary life history requirements: nesting and brood rearing. These productive wetlands provide valuable invertebrate food for developing ducklings, while the emergent vegetation provides good cover from predators and bad weather. Birds use both deep and shallow emergent vegetation to construct floating or elevated nest structures, while brood rearing habitat (consisting of open water and submergent vegetation) provides the forage base for fledgling waterbirds. Maximum nesting densities are realized where the deep emergent marsh component retains a complex edge, relative to the open water component, and there is a 50:50 mix of these two components within any given management unit (Weller and Spatcher 1965).

However, the Refuge is now faced with management limitations associated with water availability due to the lowering of the water table in the Eastern Snake River aquifer over the past 30 years and anthropegenic modifications to Camas Creek (see Objective 1.4). Agricultural interests are now placing an extraordinary pressure on groundwater resources within the Snake River aquifer (Konikow and Kendy 2005). Groundwater pumped from the Eastern Snake River Aquifer accounts for 1.14 million acre-feet, or 14 percent of discharge. Nearly all of this groundwater is pumped for irrigation (95 percent), about 3 percent is pumped for drinking water for cities and rural homes. The remaining 2 percent is pumped for industrial and livestock use (IDEQ 2006; Smith 2004). The combination of agricultural irrigation diversion and groundwater pumping have combined to impact groundwater discharge wetlands within the Camas and Beaver watersheds (IDEQ 2005), and water tables in the Camas area have dropped 15 to 20 feet since the 1980s. Incision of Camas Creek has compounded the situation (see Chapter 3).

For much of the Refuge's history, wetland impoundments were flooded in spring with water diverted from Camas Creek. Due to a high water table, these wetlands could be brought to full pool quickly and retained water throughout the summer. However, due to lowering water tables, groundwater pumping is currently required to maintain these wetlands through the summer. The main refuge point of diversion from Camas Creek remains in its original location and only one groundwater well has been moved since the original drilling of the seven irrigation wells. From this main diversion point on Camas Creek, water must flow 2 miles in order to reach the first managed wetland basin, resulting in losses to evaporation and seepage. Under current conditions, the only three basins that can be reliably hydrated to provide hemi-marsh habitat are Big, Redhead, and Toomey Ponds (285 acres total). The other three basins (Spring, Center, and Two-Way Ponds, 498 acres total) are difficult or impractical to hydrate throughout the brood rearing season. All of these basins were historically composed of deep marsh habitat before refuge impoundment construction and are presumed to have tighter pockets of hydric soils, which held permanent water prior to the 1980s, when groundwater levels were higher. It is not known at this time if current hemi-marsh and submergent plant communities can be maintained with current refuge water rights, given the altered hydrology of Camas Creek and the depletion and lowering of the aquifer.

To provide wetland habitat for native fish and wildlife, the Refuge must work within the altered hydrology and the continued degradation of water sources within the Snake River Basalts Region and the Sinks Watersheds. The contemporary challenge is how to simulate historic hydrologic processes within the Camas Creek floodplain (see Objective 1.4), while retaining adequate wetland acreage for the wildlife species that have come to depend on refuge wetlands. An additional challenge is to provide water levels that meet seasonal life history requirements of focal species while dynamically managing wetlands to maintain and enhance their productivity over time. Thus, attainment of the CCP wetland goal to: " … restore the natural range of variability and resiliency of degraded habitats" depends on replicating natural environmental processes (e.g., drought, flood, fire, and disturbance) among different management units, while still maintaining essentially the same acreage from year to year.

In Alternatives 2 and 3, an integrated Wetland and Riparian Rehabilitation Plan and associated NEPA document would be developed by 2017. The Plan would consider various alternatives for wetland restoration, evaluate the biological, cultural, economic, and social benefits and costs, and determine a future course of action supporting desired ecological outcomes. A three-tiered process would be used to develop the Plan: (1) identification of management objectives, and assessment of hydrologic, geomorphic, and biologic features associated with target riparian systems (e.g., Camas Creek) and associated wetlands; (2) implementation of wetland and riparian pilot projects to evaluate biological and physical responses to management action and assess management objectives; and (3) working with partners to develop a decision support system to support an integrated wetland/riparian rehabilitation plan and associated NEPA document. The first two years (2014-15) would be spent collecting necessary information (geomorphological, hydrological, and biological assessments). The next four years (2014-2017) would be used for implementing and monitoring pilot projects to gain a better understanding of system response to enhancement activities. Implementation of the Plan would take place from 2017-2027.

In the interim period while the Plan is being developed (2014-2017), changes in water management and increased riparian streamflow are required to improve riparian function (see Objective 1.4). Increased riparian streamflows would lessen the availability of water to be diverted into wetland impoundments, and would correspondingly decrease deepwater wetland habitats by approximately 40-120 acres (7-14% decrease from present) from 2014 to 2017. From 2014-2017, the Refuge would reduce the extent of hemi-marsh to occur within only 3 to 4 of 6 core wetland basins. However, the Refuge would considerably improve water management capability by moving the main point of diversion and irrigation wells downstream closer to the wetlands, reducing losses to evaporation and seepage. Therefore the Refuge would prioritize the use of limited water resources while simultaneously improving the quality of wetland habitats for waterfowl and waterbirds.

Although the extent of deepwater wetlands in Alternatives 2 and 3 would be reduced as compared to Alternative 1, wetland productivity is anticipated to increase due to a more dynamic and variable water management approach that mimics the natural range of wetland variability. In wetlands, emergent vegetation structure, and interspersion of emergent vegetation and open water have been demonstrated to be associated with diversity and abundance of breeding-bird species in the northern prairies (Kaminski and Prince 1984; Murkin et al. 1982; Weller and Fredrickson 1974; Weller and Spatcher 1965). Specifically, northern prairie wetlands with a 50:50 ratio of interspersed emergent vegetation to open water had a higher diversity and abundance of breeding wetland bird species than those wetlands containing more or less interspersed emergent vegetation (Kaminski and Prince 1984; Murkin et al. 1982). However, the term "hemi-marsh" (used to denote an approximately 1:1 interspersion of open water and emergent vegetation) has usually been far too stringently interpreted and managed at too small of a spatial scale (Fredrickson 1979). Although a 1:1 ratio of open water to wetland vegetation may be desirable, it is not practical or attainable on all units at all times.

Attempts to maintain a consistent 1:1 interspersion of open water and submerged to deep emergent vegetation has too frequently resulted in wetland hydroperiods that are invariable from year to year. Although high short-term productivity may result from this management, it is usually followed by static habitat conditions and long-term reductions in the wetland productivity. From a management perspective, the hemi-marsh can be difficult to maintain for long periods. Over time, wetlands can become completely dominated by continuous stands of cattails of bulrush, with little or no value to wildlife. On the other hand, if water levels are too deep the wetland can become devoid of emergent vegetation. Therefore a clear understanding of both the spatial and temporal relationships of managing natural variability in a "hemi-marsh" remains essential to ensure long-term productivity of the perennial emergent marsh (Smith et al. 2004).

In Alternatives 2 and 3, the Refuge would make adjustments in the timing and amount of drawdown in a wetland unit or complex to allow for increased hemi-marsh stage. Additional activities, such as fire management and manipulation of muskrat populations, would also aid in achieving hemi-marsh conditions. Refuge wetlands would be managed at different successional stages. The Refuge's hemi-marshes would experience periodic drying or drawdown cycles which regulate vegetation growth, thereby positively benefitting waterbird species (Lor and Malecki 2006).

In Alternative 3, upland habitat restoration and wetland/riparian rehabilitation receive equal emphasis and would likely compete for limited resources (refuge staff time, funding, as well as grant opportunities and partnership involvement). Such an approach would be analogous to fighting a war on two fronts (Wu et al. 2000), possibly compromising the success of either effort (Botrill et al. 2008; Mackenzie 2008). Conversely, Alternative 2 would prioritize wetland/riparian rehabilitation, while moving forward strategically with limited upland habitat rehabilitation efforts. Alternative 2 allows for flexibility in the amount of progress that is made depending on the availability of resources, using optimal decision-making tools to indicate the best allocation of such resources to achieve conservation objectives, and adaptive management practices related to pilot projects on the Refuge. This alternative also offers the advantage of using other available resources if they become available through agency funding, partnerships, etc. to work on upland habitat restoration, while focusing efforts on wetland and riparian hydrology assessments and pilot projects necessary for developing the wetland/riparian rehabilitation plan.

The comprehensive, science-based approach to hydrology and wetland and riparian management proposed in Alternatives 2 and 3 would increase the likelihood of providing suitable and productive wetland habitats within this highly modified landscape. Wetland and riparian rehabilitation efforts would involve the assessment of current water quality/quantity, habitat conditions, site potential, and vegetative trend, and would seek increased understanding of hydrologic connectivity within connected aquatic systems. The understanding gained through these efforts would assist refuge staff and partners in returning the Camas NWR wetlands to their once significant prominence in the Pacific Flyway. Increased partnerships with subject matter experts and funding agencies would be the key to this effort's success (Curtis 1998).

Fire Management: In all alternatives, prescribed fire would be used to reduce stands of dense emergents (e.g., cattail, bulrush, phragmites, reed canarygrass), while maintaining areas of open water for birds to forage. Under current management, burning of wetland occurs in spring (March 1-April 15) and fall (September 20-October 30.) Spring burns must take place before the nesting season to avoid bird mortality, an important seasonal constraint limiting spring burns to the earlier months (Weller 1994). This limits the efficacy of spring burns in reducing dense emergent vegetation. In Alternatives 2 and 3, the Refuge would modify the timing of burns, to increase their efficacy in removing dense emergent vegetation. We would attempt to shift toward summer burns, instead of spring or fall burns, where feasible. Summer burns are more effective in controlling tall emergent vegetation, whereas fall or spring burns promote rejuvenation of reed canarygrass (Apfelbaum and Sams 1987), cattail (Mallik and Wein 1986), phragmites (Thompson and Shay 1985) and cordgrass (Johnson and Knapp 1995). However, both summer and fall burns must be timed such that either (a) wetlands can be hydrated immediately after the burn, or (b) burns are timed with snowfall, to avoid post-fire wind erosion. Effective cattail control is usually attained by drawing down water levels, conducting a summer burn, and then re-flooding the unit, drowning the cattail rhizomes for several weeks. The resulting open-water area will be free of cattail for at least two years, and is attractive as duck foraging areas.

Objective 1.2: Seasonal and Shallow Marsh Habitat Management

a) Over the lifetime of the CCP, maintain and enhance *1,743-1,803 acres* of seasonal to semipermanent wetland habitat in managed wetland impoundments.
b) *From 2014-2017,* increase seasonally flooded shallow marsh habitat (moist soil units) to *150-200 acres* that provides conditions essential for the conservation of select focal wildlife species, while simultaneously working *to develop a Wetland and Riparian Rehabilitation Plan by 2017* to rehabilitate Camas Creek and refuge wetlands.

Benefitting Refuge Species:
American avocet, northern leopard frog, cinnamon teal, sora, Virginia rail

Seasonally flooded shallow marsh is characterized by the following attributes:

- Mineral or shallow organic soils that are moist to saturated and only seasonally inundated.
- Large zones of sedge and Baltic rush, with dense smartweed stands along the shallow edge and a periphery of a shallow emergent cattails in sparse unconnected stands.
- Flooded to a depth of 18"-24" April-June, with water depths in very shallow smartweed areas targeted for 4"-10" by July-August.
- Semipermanently to seasonally flooded. Typically only inundated with very shallow standing water throughout the year, although the substrate may be exposed in dry years.
- <10-15% cover of invasive plants (e.g., Canada thistle, smooth brome, reed canary grass)

Alternatives *Objective as written above is modified by replacing acres in italics with the text in this row.*	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Timeframe:	For the life of the plan	From 2014-2017	
Total seasonal and semipermanent wetland acres managed:	1,213 acres	1,743-1,803 acres	
Total seasonal shallow-marsh (moist soil) acres managed:	40-60 acres	150-200 acres	
Develop Wetland and Riparian Rehabilitation Plan		By 2017	

Strategies Applied to Achieve Objective	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Allow seasonal shallow marsh (moist soil) habitats to fluctuate in size (40-60 acres) in response to Hemi-Marsh management. Under current management shallow marsh habitat would be located and along the edges of hemi-marsh.	✓		
From 2014-2017, develop a Wetland and Riparian Rehabilitation Plan (WRRP) and associated NEPA document for Camas NWR using a three-tiered process (see Objective 1.1 above).		✓	✓
From 2014-2017 (until the WRRP is developed), increase the extent of seasonal shallow-marsh (moist soil) habitats to 150-200 acres, by managing wetland hydroperiod on a rotational basis for shallow marsh habitat. Decrease the current emphasis on consistently providing deep hemi-marsh habitats.		✓	✓

By 2017, promote seasonal freshwater overbank flooding from Camas Creek into historic ephemeral wetlands and playas, as well as into vegetated semipermanent shallow marshes, sufficient to create mudflats and maintain a shallow-water shoreline for the longest possible period.		✓	✓
Manage seasonally flooded wetlands for a variable, but at least 2 month, dry period in the late summer (July/August) of each year to maintain abundant populations of invertebrate forage.		✓	✓
Manage or restrict surface disturbing activities in historic seasonal wetlands and playas to protect the integrity of the clay soil pan and maximize water retention.		✓	✓
Encourage smartweed production and growth along shallow marsh edges through the timing of early spring (April/May) drawdowns of hemi-marsh units and fall re-flooding in mid-August.		✓	✓
Conduct very shallow soil disturbance (e.g., light disking, harrowing) in 25-35% of established seasonally flooded smartweed communities every 3-5 years.		✓	✓
By 2017, upgrade existing water control structures and reconfigure impoundments to allow finer scale management of water levels within units with a predominance of shallow marsh.		✓	✓
Every 3 years assess emergent cover using aerial photography, ground-truthing, and GIS analysis to determine responses to habitat management practices.		✓	✓
Where shallow-marsh habitat is a priority, inundate isolated cattail islands through the late summer months (semipermanent), and inundate sedge and Baltic rush until early summer months (seasonal).	✓	✓	✓
Use groundwater water rights and pumping to compensate for losses of wetland surface water to groundwater seepage and recharge.	✓	✓	✓
Use prescribed fire, disking, and mowing to reduce cover of emergents and create mosaic patterns within wetlands when water level manipulations prove insufficient to maintain shallow-marsh attributes.	✓	✓	✓
Annually maintain and repair water pumps, control structures, and ditches.	✓	✓	✓
Annually document all water level manipulations and hydroperiod.	✓	✓	✓
Annually document all habitat manipulations.	✓	✓	✓
Use IPM strategies including mechanical, physical, biological, and chemical means to eradicate, control, or contain invasive and undesirable plants (see Appendix F-IPM Program).	✓	✓	✓

Rationale, Objective 1.2, Seasonal and Shallow Marsh Habitat Management:

Prior to agricultural development, the area now known as Camas National Wildlife Refuge was composed of a diverse mosaic of shallow seasonal and semipermanent wetland and wet meadow habitats, surrounded by an expansive sea of sagebrush. The primary source of water for these wetlands was surface water via overbank flooding of Camas Creek (see Chapters 3, 4).

Providing a diversity of shallow seasonal wetlands is vital to the Refuge's purpose of providing habitat for a variety of breeding and migrating waterbirds, especially waterfowl. Yet the Refuge must largely work within an established wetland infrastructure that was designed in the 1960s, primarily to provide deep hemi-marsh habitat. Additionally the Refuge is now faced with management limitations associated with water availability due to the lowering of the water table in the Eastern Snake River aquifer (see Objective 1.1). Due to these issues, 595 acres of wetland impoundments that were formerly managed as seasonal wetlands (including Wet Marsh, Moose, Ruddy, and Pintail Ponds) have been placed in inactive status and currently support a mixture of wet meadow and non-native wet meadow vegetation (see Chapter 4). Another 1,213 acres of wetland impoundments (in addition to the core wetlands described in Objective 1.1) are managed as seasonal to semipermanent wetlands. These include Avocet and Brindley Ponds, Cattail Flat, Mallard Slough, and Rays Lake. Although these wetlands can demonstrate impressive productivity when adequate water is available, in most cases the Refuge currently has limited ability to hydrate these wetlands. Intensive management of Rays Lake is not feasible, and irrigation demand is the principal determinant of the lake's pool. Under Alternatives 2 and 3 we propose to reduce acres managed as hemi-marsh by 530-590 acres; the managed wetland basins managed as seasonal to semipermanent wetlands would correspondingly increase.

Seasonal shallow wetlands (moist soil) can be highly productive for waterfowl (Smith et al. 1964) even though production fluctuates widely from year to year with wetland conditions (Crissey 1969; Dzubin 1969). Evans and Black (1956), Drewien and Springer (1969), and Jenni (1956) stressed the importance of small, small seasonal wetlands to dabbling ducks during spring and early summer. Kantrud and Stewart (1977) compared pair densities on a series of glacial pond types of varying permanence and found some of the highest densities of dabblers occurred on temporary ponds; in the case of blue-winged teal, extremely high densities occurred on ephemeral wetlands. Similarly, Ruwaldt et al. (1979) found unusually high densities of blue-winged teal pairs on ephemeral wetlands in South Dakota and generally high densities of waterfowl on temporary wetlands. While deep marsh habitats provide ample protection from predators, seasonal wetlands usually supply a much greater abundance of invertebrates (De Szalay and Resh 2000; Euliss et al. 2004). Invertebrates are the primary source of dietary protein for ducks and other wetland birds during the breeding season (Murkin and Kadlec 1986; Swanson and Meyer 1977).

While Camas NWR infrastructure was not specifically designed for moist-soil management, opportunities still exist to provide increased seasonally flooded habitat for migratory birds, both during the breeding season, and during fall migration. Increasing the distribution of seasonal foraging wetlands dominated by smartweed, adjacent to semipermanent wetland impoundments with abundant cover and security would increase use by dabbling ducks, particularly mallards. Smartweeds' complex leaf structure supports both high invertebrate abundance and diversity when flooded (Fredrickson and Taylor 1982). Since invertebrate populations decline with prolonged flooding, allowing these seasonal wetland basins to dry for at least two months each year, as proposed in Alternatives 2 and 3, is essential for maintaining abundant populations of invertebrates (Fredrickson and Taylor 1982; Reid et al. 1989).

Smartweed provides waterbirds with a quality food source during fall migration. Smartweed seeds contain balanced proportions of essential vitamins, protein, minerals, and carbohydrates (Gray et al.1999). Smartweed requires cool soil temperatures (roughly in the low 60s) and relatively high soil moisture for germination, and therefore, is usually found in wetlands that undergo early spring drawdowns (Fredrickson and Taylor 1982; Kadlec 1962; Meeks 1969). Smartweed is considered a "pioneer" or "invader" plant species because it colonizes recently disturbed wetland sites. Eventually, competition from other wetland plants, particularly cattails and bulrush, would eliminate smartweed from the community. Smartweed can be maintained in seasonal wetlands for several years if water management coincides with its growth requirements (Reinecke et al. 1989). Periodic soil disturbance every three to four years, as proposed in Alternatives 2 and 3, would be essential to the maintenance of smartweed stands. Disturbing older smartweed stands would increase smartweed abundance substantially and allow more palatable and nutritional stands of smartweed to re-establish (Gray et al.1999a; Rundle 1981).

By increasing seasonal shallow wetland (moist soil) habitat at Camas NWR, the Refuge would be able to provide diverse and critical migration and breeding habitat to waterfowl, wading birds, and other wildlife species. Of particular importance, the shallow, extensive wetland habitats on this site would provide important feeding and resting habitat for spring migratory waterbirds. Camas Refuge is an important stop-over for northward migrating waterbirds that breed in Alberta, Saskatchewan, Alaska, and other northern breeding areas (Ivey and Herziger 2006). The restoration and increase of seasonal wetland habitat would provide breeding habitat for several species at Camas NWR, including mallards, Canada geese, northern shovelers, gadwalls, cinnamon teal, and blue-winged teal.

Objective 1.3. Wet Meadow Habitat Management

From 2014-2017, **maintain 1,958 acres of existing wet meadow habitat and enhance** ***80-100 acres*** **of wet-meadow complexes,** ***while*** **simultaneously working to** ***develop a Wetland and Riparian Rehabilitation Plan by 2017*** **to rehabilitate Camas Creek and refuge wetlands and** ***restore 140-200 acres*** **of natural wet meadow habitat associated with Camas Creek by 2027.**

Benefitting Refuge Species:

Long-billed curlew, greater sandhill crane, short-eared owl, American avocet, northern leopard frog, cinnamon teal, bobolink

Wet Meadow is characterized by the following attributes:

- Hydric soils on flat or very gently sloping topography
- Mix of palatable forage with a height of <6" by October.
- >75% species composition of sedges, western wheatgrass, rush and foxtail barley, with small patches or large flats of alkali meadows
- 15-20% cover of forbs such as lupine, clover, and cinquefoils
- < 5% cover of native shrubs.
- Soils moist to saturated during the growing season to 6"-12" in water depth. Wet meadows may naturally receive no surface flooding in very dry years.
- Temporarily flooded (April-July), with very shallow water depths (< 6") by mid-June
- Fresh water (<1,000 ppm TDS) fosters wet meadow plants establishment; where hydrology has favored natural evaporative areas over time, alkali meadow halophytes would predominate the site.
- Isolated micro-depressions of seasonally flooded sloughs would hold water into the early fall.
- <10% cover of invasive plants (e.g., Canada thistle)
- Preferable patch size ranges from 2 to 45 acres with a minimum predator-detection width of 250 feet

Alternatives *Objective as written above is modified by replacing acres in italics with the text in this row.*	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Timeframe:	For the life of the plan	From 2014-2017	
Total wet-meadow acres managed:	60-70 acres	80-100 acres	
Develop Wetland and Riparian Rehabilitation Plan:		By 2017	

Restore wet-meadow habitat associated with Camas Creek		140-200 acres
Additional wet meadow acres restored:	60-70 acres	80-100 acres

Strategies Applied to Achieve Objective	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Use groundwater and surface water rights to irrigate 80-100 acres of wet-meadow habitats, with the commencement and duration dependent upon site-specific objectives.	✓		
Use existing water management infrastructure to encourage hemi-marsh habitat maintenance and manage small peripheral wet meadow sites.	✓		
Manage wet meadow habitat potential being cognizant of hydrological gradients that drive plant community expression and by establishing a natural range of variability in flooding prescription which allow for long-term, dynamic management to maintain or enhance the integrity of this habitat type.		✓	✓
Maintain/enhance management units within this habitat type through the use of active successional vegetation management (e.g., haying, seeding, discing, grain farming—see Goal 3; Objective 3.1, 3.2, and 3.3).	✓	✓	✓
Enter into Cooperative Land Management Agreements (CLMA) with haying permittees to inter-seed native wet meadow grass plantings in exchange for refuge hay tonnage.		✓	✓
From 2014-2017, prevent further riparian stream incision where possible to improve ecological conditions or maintain existing wet-meadows, while lessening further natural wet-meadow degradation.		✓	✓
From 2014-2017 maintain wet meadow sites that are beginning to lose their potential to support wet meadow types and are exhibiting a slight change from wet meadow to mesic meadow species composition due to hydrologic modifications, by initiating spring or stream bank stabilization pilot projects with planted plugs or transplants of meadow grasses, sedges, and rushes and riparian woody vegetation on low to moderately incised channels.		✓	✓
From 2014-2017 or until more natural hydrologic processes can be reinstated, remove encroaching upland shrubs in wet-meadows through active physical or mechanical management in wet-meadow sites that have transitioned toward dry or sage meadows.		✓	✓
Over the life of the plan, control/eradicate non-native cool-season grasses in native wet meadow sites. Experiment with techniques to rehabilitatee wet meadows, including: 1) Broad spectrum herbicides (i.e., glyphosate, imazapyr) to reduce plant height, promote competition, decrease rhizome reserves, and create dry biomass for fire; 2) Grass-specific herbicide (i.e., sethoxydim, fluazifop) to suppress grass growth, release natives, control regrowth after burning/mowing; 3) Spring burning in combination with other practices to remove litter/thatch prior to seeding, kill seeds, reduce available nitrogen, force cool-season grasses to re-sprout and use rhizome reserves; 4) Mow or hay to reduce biomass/nutrients, reduce height, promote seed establishment, change fire behavior;		✓	✓

5) Tillage to fragment rhizomes or in combination with chemical control to expose rhizomes to light and activate dormant buds to make them more susceptible to herbicides, and prepare new seedbed; 6) Native seeding and propagation of treated sites.			
From 2014-2017, develop a Wetland and Riparian Rehabilitation Plan (and associated NEPA document) for Camas NWR using a three-tiered process (see Objective 1.1).		✓	✓
From 2014-2015, conduct surveys and assessments needed to develop the Wetland and Riparian Rehabilitation Plan: 1. Annually measure and monitor shallow groundwater depths, using soil augers, digging soil pits or installing groundwater wells, to quantify the depth to saturation of the water table to determine site-potential for wet meadow maintenance, enhancement, and rehabilitation efforts. 2. From 2015, assess the likelihood for geomorphic change and the probability that these alterations would result in further declines in groundwater levels and, thus further changes in wet-meadow vegetation. 3. By 2017, formulate and use plant community-specific tolerance thresholds, as determined through a Camas NWR State-and-Transition Model, to influence management prescriptions to meet annual and long-term wet meadow habitat objectives.		✓	✓
From 2017-2027, as required and identified in the Camas NWR Wetland and Riparian Rehabilitation Plan, restore wet-meadows on valley fans with convex side-valley profiles by installing in-stream grade control structures (e.g., Cross-vanes, J-hooks, Rock vanes, W-weirs, check-dams, K-dams, jack dams, wedge dams, dams, log/rock sills, log drop structure) to prevent and minimize further riparian incision of the main Camas Creek channel, prevent incision in spring channels, and maintain existing springs and seeps that feed wet-meadows.		✓	✓
From 2017-2027, as required and identified in the Camas NWR Wetland and Riparian Rehabilitation Plan, decrease upstream gully propagation from headcut advancement occurring from the combined effects of surface and groundwater (seepage) erosion associated with shallow groundwater and layered stratigraphy, by assessing options and installing as required: 1) in-stream check dams and weirs to stabilize the base level and retain sediment; 2) re-grading and vegetating the gully banks and headcut to increase channel cross-sectional area and reduce shear stress to lesson bank failures; 3) lining headcuts and banks with rocks or erosional resistant materials; and 4) spreading or diverting surface flows to reduce the volume of water entering the gully and to limit the concentration of erosional forces of surface flows.		✓	✓
From 2017-2027, modify dikes, ditches, and other infrastructure, as identified in the Camas NWR Wetland and Riparian Rehabilitation Plan to manage impounded wet meadow habitats in the most productive and efficient manner.		✓	✓
Use IPM strategies including chemical, mechanical, horticultural, and biological control agents to control/eradicate invasive plants (see Appendix F).	✓	✓	✓

Rationale, Objective 1.3, Wet Meadow Habitat Management:

Wet meadows are seasonally and temporarily flooded marsh dominated by low stature, flood tolerant, annual and perennial plants. For the majority of waterbirds, this habitat type provides seasonal food reserves to fulfill specific phases in their life history strategy (Garay et al. 1991; Kaminski and Prince 1984; Pyrovetsi and Crivelli 1988). Wet meadow habitats are distinct from alkali meadows primarily by the quality of water typically hydrating the marsh. Where freshwater (<1,000 ppm TDS) input is the norm, wet meadow plants become established, ranging from Baltic rush and annual grasses, to forbs such as curly dock (Austin and Pyle 2004; Bedford et al. 1999). Historically, wet meadow habitat in the Camas NWR area was created by overbank flooding of Camas Creek, which now rarely occurs (see Chapters 3, 4). 595 acres of wetland impoundments along Camas Creek (including West Marsh, Moose, Ruddy, and Pintail Ponds) have been placed in “inactive” status due to lack of water to reliably hydrate them. Vegetation in these wetlands is currently classified as a mixture of wet meadow and lowland non-native vegetation.

Meadow management. Much of the Refuge’s wet meadow habitat has a history of being either grazed or hayed, or both. As a result of this history, much of the Refuge’s historic wet meadow and shallow wetland habitat (2,748 acres) is now dominated by non-native plants. Most of the Refuge’s extant wet meadow habitat (1,958 acres) is dominated by Baltic rush. Although Baltic rush is a native species, it tends to increase in abundance under heavy grazing pressure. In addition, at one point in the history of Camas NWR, approximately 500 acres of wet meadows were leveled, and infrastructure for flood irrigation was constructed to support production of small grains. Once farming was stopped in the late 1970s, these areas were left as fallow. In most recent history these areas have been hayed through Cooperative Land Management Agreements, but the vegetation is for the most part introduced non-native species such as smooth brome and quackgrass.

Over the lifetime of the CCP, approximately 80-100 acres of selected fallow fields would be rehabilitated to wet meadow habitat. Future management strategies would target reducing non-native cover and increasing native grass and forb species as noted in Objective 1.3. However, restoring native wet meadow habitat in areas dominated by non-natives is time and resource-intensive, requiring two to three years of initial treatments, and continued monitoring and follow-up for five to ten years to prevent reinfestation (Kilbride and Paveglio 1999; Paveglio and Kilbride 2000; Tu 2004). To ensure long-term habitat integrity of at-risk wet meadows, a combination of wetland flooding and water schedule adjustments, the designation of alternative suitable acres to meet irrigation prescriptions, and/or cool-season grass treatments may be used. Treatments may include disking, mowing, chemical applications, or prescribed fire to restore native components in cool-season non-native grass monocultures.

In managing wet meadow habitat within impounded wetlands, the Refuge would remain cognizant of hydrological gradients that can drive plant community expression and subsequent habitat quality and availability for target wildlife species. In impounded wet meadow habitat it is important to establish flooding prescriptions that accommodate the habitat needs of focal wet meadow species. The Refuge would carefully identify priority areas for both focal species and for the larger successional characteristics needed to meet management objectives. Through dynamic management, the Refuge would seek to maintain or enhance the integrity of wet meadow habitats in areas where historic subtle variations in topography have been compromised by past land-use practices, or where an unacceptable percentage of plant assemblages is shifting toward undesirable species.

Habitat restoration. Wet meadow ecosystems have complex hydrologic connections to surface and sub-surface groundwater, and are influenced by riparian stream incision, groundwater lowering, and vegetation degradation based on their geomorphic and hydrologic controls and disturbance history (Castelli et al. 2000). Stream diversions, modifications of springs and seeps, and groundwater pumping can result in both direct and indirect effects on wet meadow water tables. Water-table declines can cause shifts meadow plant composition from mesic to xeric species and decrease in the overall extent of the ecosystem (Rosgen 1996). Riparian stream incision that causes a significant drop in the water table may cause natural wet meadows to transition to a new, drier ecological type with a new site potential (Leopold et al. 1964). This transition from wet to dry ecological types is already occurring on the Refuge (see Chapter 4) and appears to be influenced, in large part, by anthropogenic modifications to Camas Creek (incision and gully formation) and land use practices in the surrounding watershed.

Camas Creek is a degraded, incised, and highly unstable riparian corridor. In Alternatives 2 and 3 we propose to develop a Wetland and Riparian Rehabilitation Plan (WRRP) and associated NEPA document by 2017 that would address causes of habitat degradation and at least partially restore natural hydrologic processes on the Refuge (see Objectives 1.1, 1.4). Restoration and management objectives and approaches are most effective when based on an understanding of ecosystem processes and the long- and short-term causes of disturbance (Wohl et al. 2005). It is therefore paramount that before Camas NWR identifies long-term management objectives and strategies in the WRRP, we further assess the Refuge's physical setting and characteristics and wetland functions. Therefore, a three phased approach is proposed: (1) assessment, 2014-2015; (2) implementation and evaluation of pilot projects (2014-2017), and (3) developing a decision support system (see Objective 1.1).

Because natural meadow complexes are groundwater features closely tied to the riparian surface channel systems, the ongoing HGM assessment is of utmost importance in assessing the effect of channel incision on groundwater levels, documenting current and potential vegetation types, and determining the linkage between the channel and groundwater flow systems (Chambers and Miller 2011; Currier 1989; Galatowitsch et al. 2000). Likewise, thoroughly assessing the current conditions of key indicators would allow comparison to the acceptable range of variability along the successional trajectory of wet-meadow and riparian habitats. Collecting these data would allow the Refuge to better characterize current conditions and implement a programmatic-level evaluation of watershed scale data (Munro et al. 2007). Important data sets relevant to evaluating riparian conditions in relation to trigger-points would include remote sensing imagery (e.g., satellite imagery, LiDAR, aerial photos), water gauging station flow rates, and resampling permanent plots. Data from these sources are not only essential for development of the WRRP, but for adaptive management and are and recommended as part of the long-term monitoring program.

The Camas NWR Wetland and Riparian Rehabilitation Plan would be based on careful assessment both of the dominant geomorphic and hydrologic controls and of the causes of disturbance at watershed, valley segment, and site scales. This plan would also consider the current magnitude of incision or degradation and the potential for stream stabilization and vegetation management (Chambers and Miller 2011). In the interim period before the Plan is completed, active management in former wet meadow sites is necessary to improve the ecological condition of these sites and to prevent them from transitioning into dry or shrub meadows with weedy species invasions or undesirable species compositions (Wright and Chambers 2002). Because water table depths are highly variable both among and within years in mesic, dry, and sage meadow ecological types (Castelli et al. 2000; Martin and Chambers 2002), groundwater monitoring activities would be conducted several times during the growing season and for at least two years prior to wet meadow/riparian rehabilitation (Chambers et al. 2004).

Camas NWR will face extremely challenging issues in the rehabilitation of the aggraded gullies within Camas Creek. Gully formation is a degraded condition much worse than incision, and is not only the product of altered surface flows, but result from the combined effects of both surface and groundwater (seepage) erosion associated with shallow groundwater levels and layered stratigraphy. Thus, treatment options identified in the Camas NWR Wetland and Riparian Rehabilitation Plan must include measures to deal with multiple mechanisms of erosion that may occur at different times and under different hydrologic conditions (Ponce and Lindquist 1990). Complicating the problem further, data with which to evaluate the effectiveness of headcut and gully mitigation strategies in meadow complexes in the region are limited. Identification of the most appropriate headcut and gully management actions would be addressed in the WRRP and would depend on results of the HGM report and the gully's current morphology, its hydrologic and geologic setting, its position and integration within the drainage network, and the mechanisms responsible for headcut migration.

Objective 1.4 Camas Creek Riparian (In-Stream and Willow) Habitat Management

From 2014-2017* maintain and restore *8 miles* of in-stream Camas Creek habitat, *100-150 acres* of willow riparian habitat associated with Camas Creek, and maintain and enhance 239-259 acres of willow shrubland in wetland areas, while simultaneously working to *develop a Wetland and Riparian Rehabilitation Plan by 2017* to rehabilitate Camas Creek and refuge wetlands and *re-establish sustainable fluvial systems and riparian ecosystems for Camas NWR wetland and riparian habitat by 2027.

Benefitting Refuge Species:

Riparian Stream: American dipper, Northern leopard frog, belted kingfisher, mink

Riparian Woodland: Willow flycatcher, dusky flycatcher, yellow warbler, black-billed magpie, calliope hummingbird

Riparian habitat is characterized by the following attributes:

- Smaller drainages and isolated seeps, typically subject to an ephemeral, spring flooding regime (0"-12" in depth).
- Channel form (e.g. sinuousity) and substrate composition consistent with geomorphic and hydrologic setting.
- Natural stream banks and cross-section profile, consistent with stream gradient segment.
- Pulse channel flows >200 cfs for 3-4 months in duration. Extreme events estimated at or above 200 cfs, with over-bank flooding occurring on occasion, dependent upon precipitation.
- Areas of bare soil (e.g. point bars) available for recruitment of bottomland trees.
- Presence of large woody debris (LWD: greater than 10 cm [3.9 inches] diameter and 1 m [3.3 feet] in length) in stream channel.
- Connectivity among habitats (i.e., unimpeded passage within channels, floodplain regularly flooded, continuous site-appropriate vegetation along riparian zones)
- 40-80% cover of understory native shrubs (e.g., yellow willow; whiplash willow; peachleaf willow; black hawthorn, red osier dogwood, Wood's rose) that are >3 feet tall in associated riparian areas with shallow water table.
- <40% canopy cover of native trees, primarily narrow-leaf (coyote) willow
- >10% cover of herbaceous layer sedges, tufted hairgrass, bluegrasses, foxtails, timothy, and forbs.
- <5% cover of invasive plants (e.g., reed canary grass, Canada thistle) or noxious species.

Alternatives *Objective as written above is modified by replacing acres in italics with the text in this row.*	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Timeframe:	For the life of the plan	From 2014-2017	
Total riparian in-stream (lotic) miles managed:	Maintain 4 miles	Maintain and restore 8 miles	
Total willow riparian (lentic) acres associated with Camas Creek:	20-40 acres	100-150 acres	

Develop Wetland and Riparian Rehabilitation Plan:		By 2017	
Re-establish sustainable fluvial riparian systems:		By 2027	
Strategies Applied to Achieve Objective	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Maintain extent of current willow and shrub habitat where possible given the constraints of water rights requirements.	✓		
Maintain 1 point-of-diversion along Camas Creek for wetland surface water diversion and allow Camas Creek banks to remain raised and diked with minimal overbank flooding occurring approximately every 1 in 6 years, and major events 1 in 20 years.	✓		
Divert the majority of Camas Creek surface waters (58.1 cfs) from April-July in an average flow year to inundate refuge wetland impoundments.	✓		
Manage for Camas Creek riparian flows below the diversion point for approximately 3-6 weeks annually, only when flows above 58.1 cfs occur.	✓		
Allow the banks of Camas Creek to remain altered (diked and incised) with minimal overbank flooding occurring.	✓		
Over the life of the plan work to halt, minimize, or mitigate activities which are the causal factors for riparian habitat degradation.		✓	✓
From 2014-2017, develop a Wetland and Riparian Rehabilitation Plan (and associated NEPA document) for Camas NWR using a three-tiered process: 1. 2014-2015: Assessment of hydrologic, geomorphic, and biologic features associated with target wetland (i.e., hemi-marsh, shallow marsh, and wet meadow) and riparian (i.e., riparian and riparian woodland) systems; 2. 2014-2017: Implementation of wetland pilot projects to evaluate biological and physical responses to management action and assess management objectives; and 3. 2017: Work with partners to develop a decision support system to identify management objectives and support an integrated approach to rehabilitating wetland and riparian habitats in the Plan.		✓	✓
From 2014-2015, conduct surveys and assessments needed to develop the Wetland and Riparian Rehabilitation Plan: 1. Conduct Hydro Geomorphic Model (HGM) and engineering feasibility study by 2015 (See Goal 4; Objective 4.1) to determine historic and current physical refuge setting and best future management options. 2. From 2014-2015, survey refuge portions of Camas Creek to identify reaches with: a) relatively intact (few anthropogenic impacts evident) and worthy of maintenance or protection management strategies; b) reaches where restoration is feasible with changes in current land-use practices or without large expenditures of resources; c) reaches that could be restored, but only at high cost; and d) those reaches that are in a condition where restoration is not technically feasible due to extreme conditions of alteration, degradation, or sociopolitical issues.		✓	✓

From 2014-2017, implement pilot projects to assess management objectives for the Wetland and Riparian Rehabilitation Plan: 1. Construct pilot projects for new diversion structures and additional points-of-diversion to test the capacity to increase the efficacy of water delivery to only partially deflect Camas Creek flows into managed wetlands, while allowing partial flow to remain in the Camas Creek channel. 2. Initiate pilot projects to decrease water loss in Camas Creek channel, including artificially lining the upper main Camas Creek canal to decrease surface water loss to groundwater recharge and increase available riparian water downstream. 3. From 2014-2017, initiate spring or stream bank stabilization pilot projects with planted plugs or transplants of meadow grasses, sedges, and rushes and riparian woody vegetation on low to moderately incised channels to maintain riparian sites that are losing their ability to support riparian habitat types.		✓	✓
Between 2014 and 2017, implement pilot project to lower the banks of Camas Creek on the Refuge at strategic locations, as consistent with Idaho Water Law, to increase the occurrence of natural overbank flooding.		✓	✓
Upon completion of the Wetland and Riparian Rehabilitation Plan in 2017, design a new water delivery system (e.g., wells, canals, pipes, pumps, breaching and/or removal of dikes) to modify, relocate and restore more natural and efficient wetland hydrology, where applicable and desirable.		✓	✓
From 2014-2017, prevent further stream incision and avulsion where possible to improve ecological conditions or maintain existing riparian habitat, while lessening further riparian degradation.		✓	✓
Obtain necessary permits for implementation of Camas Creek rehabilitation and ensure compliance with Federal and State regulatory programs and requirements (e.g., NEPA; EPA/IDEQ-Sections 401, 402, and 404 of the Clean Water Act; ESA Section 7 and 10; Rivers and Harbors Act of 1899).		✓	✓
Identify and link available resources to the actions required to implement Camas Creek habitat rehabilitation and secure available funds to execute the restoration design.		✓	✓
From 2017-2027, as required and identified in the Camas NWR Wetland and Riparian Rehabilitation Plan, restore riparian in-stream habitats by installing in-stream grade control structures (e.g., cross-vanes, J-hooks, rock vanes, W-weirs, check-dams, K-dams, jack dams, wedge dams, dams, log/rock sills, log drop structure) to prevent and minimize further riparian incision of the main Camas Creek channel, prevent incision in spring channels, and maintain existing springs and seeps that feed wet meadows.		✓	✓
From 2017-2027, as required and identified in the Camas NWR Wetland and Riparian Rehabilitation Plan, decrease upstream gully propagation from headcut advancement occurring from the combined effects of surface and groundwater (seepage) erosion associated with shallow groundwater and layered stratigraphy, by assessing options and installing as required: 1) in-stream check dams and weirs to stabilize the base level and retain sediment;		✓	✓

2) re-grading and vegetating the gully banks and headcut to increase channel cross-sectional area and reduce shear stress to lessen bank failures; 3) lining headcuts and banks with rocks or erosion-resistant materials; and 4) spreading or diverting surface flows to reduce the volume of water entering the gully and to limit the concentration of erosional forces of surface flows.			
Monitor large ungulate (i.e., elk, deer, and moose) use of willow communities to ensure habitat structure is not being degraded and natural regeneration and recruitment of willows is not being inhibited.		✓	✓
Promote natural willow regeneration in established stands by physically, biologically, or mechanically treating 10% of large old stands a season to create structural diversity and habitat mosaics.		✓	✓
Use patchy low intensity prescribed fire to create mosaics of willow stands in various successional stages.		✓	✓
Seed or plant willow and red-osier dogwood along wetland edges, or other appropriate hydric areas to connect or expanding existing riparian woodlands. Incorporate techniques to discourage rodent damage to new plantings.		✓	✓
Minimize riparian channel degradation and encourage natural in-stream structure and woody debris, to the extent practical, as per existing water rights requirements for channel maintenance.	✓	✓	✓
Establish riparian plant species in formerly degraded sites by propagation and planting of willows and riparian obligate vegetation, through proper selection of species, planting locations, planting elevations and zones, plant material procurement or propagation, plant handling, and establishment techniques.	✓	✓	✓
Acquire property and water rights to increase Camas Creek base flows within the Refuge.	✓	✓	✓
Annually measure and monitor existing water rights for both groundwater and surface water usage.	✓	✓	✓
Monitor Camas Creek surface flows daily and file an end-of-the year water usage report with Water District 31.	✓	✓	✓
Monitor groundwater wells at least once a month and file end-of-year usage report with the Idaho Department of Water Resources.	✓	✓	✓
Maintain consistent and effective communication with district water masters.	✓	✓	✓
Monitor public notices of intent on modification of current and new water rights.	✓	✓	✓
Use IPM strategies including chemical, mechanical, horticultural, and biological control agents to control/eradicate invasive plants (see Appendix F).	✓	✓	✓

Rationale, Objective 1.4 Camas Creek Riparian (In-Stream and Willow) Habitat Management:

Habitat Management. Yellow warblers, willow flycatchers, and associated species require dense thickets of deciduous riparian shrubs for feeding and/or reproduction. This objective and associated strategies seek to maximize shrub density while managing for periodic disturbance to reinvigorate woody riparian stands. The greatest negative impact to riparian shrub habitat over the last century has been past grazing practices and the purposeful eradication of riparian habitats as to not impede water delivery. In recent years, livestock grazing and other impacts to woody riparian communities at Camas NWR have been significantly reduced. The result has been an increase in both the quantity and quality of this habitat type on the Refuge. In order to continue this upward trend, it will be necessary to protect these and additional potential woody riparian areas from unnecessary impacts. In target areas that are either disconnected from the floodplain, or lie outside of floodplain areas, supplemental soil moisture via flood irrigation would be used to sustain existing acres of this habitat and promote expansion. Strategic planting would be used to increase shrub species diversity. Proposed prescribed fire and mowing treatments would be infrequent, and balanced by the need for older stands of dense, undisturbed willow/shrub areas according to focal species' needs.

Habitat Restoration. Throughout the western states, riparian ecosystems have been affected by water diversions or spring and seep modifications that decrease the quantity of instream flows and result in lowered water-tables (Castelli et al. 2000). Water extraction is especially damaging in arid and semi-arid regions where the presence of instream and groundwater flows are crucial to riparian vegetation. In riparian ecosystems in the western U.S., water supply is a function of both instream flows (Rood and Mahoney 1990; Stromberg et al. 1993) and groundwater available from springs and seeps (Allen-Diaz 1991). Stream diversion, development of springs and seeps, and groundwater pumping can result in both direct and indirect effects on riparian water tables. Water-table declines can cause shifts in plant composition from mesic to xeric species and decreases in the overall extent of riparian ecosystems. The loss of riparian vegetation, in turn, can affect stream channel stability by increasing bank erosion and resulting in channel degradation or aggradation (Rosgen 1996).

Camas Creek is the heart of a complex irrigation system where groundwater is pumped into the modified creek channel to supply irrigated agriculture. Camas Creek flows reach Mud Lake reservoir, which is the endpoint for all drainage in the Beaver-Camas Subbasin. Camas Creek is §303(d) listed from its headwaters to its mouth in two segments. IDEQ (2005) determined upstream riparian grazing has contributed to bank erosion and elevated stream temperatures. Sediment and temperature TMDLs have been calculated to address the pollutants of concern in the upper segment. The lower section of Camas Creek is 303(d) listed for flow alteration, habitat alteration, sediment, nutrients, and temperature. Because this section of Camas Creek is intermittent and flow altered for irrigation, the lower segment was proposed for de-listing for sediment, nutrients, and temperature and re-listed as a flow altered reach (IDEQ 2005).

Although the effects of channelization on the Camas Creek stream ecosystem are substantial and obvious, the effects on the associated riparian and wetland ecosystem are equally significant. The effects of channelization on the Camas Creek riparian zone include reduction in frequency of floodplain inundation, reduction or elimination of natural channel migration, elimination of sediment beds used as plant recruitment areas, and lower groundwater tables. Confinement of flood flows to the channel eliminates the periodic inundation of the floodplain, and thereby decreases the level of soil moisture in the riparian zone. In meandering channels, stabilizing and fixing a channel in place eliminates point bar development and growth. Point and other channel side bars provide open areas of bare sediment available for recruitment by bottomland trees (Bradley and Smith 1985; Scott et al. 1996). Finally, channel shortening and steepening contributes to alluvial water table to drop, turning refuge groundwater-dependent riparian ecosystems into drier upland types (Groeneveld and Griepentrog 1985; Schoof 1980).

Large woody debris (LWD: greater than 10 cm [3.9 inches] diameter and 1 m [3.3 feet] in length) in stream channels has an important role in the ecological processes of lotic systems, dictating channel form, providing sites for storage of organic matter and sediment, and modifying the movement and transformation of nutrients (Bisson et al. 1987). It is well known that LWD influences the physical characteristics of streams, affecting the in-channel biological community (Bilby and Bisson 1998; Maser and Sedell 1994) as well as the dynamics of the riparian woodland (Naiman et al. 1998, 2000). Additionally, LWD on the riparian woodland floor and in the channel provides habitat for many species of wildlife (Bartels et al. 1985; Steel et al. 1999). Geomorphic evidence suggests that a stable piece of large wood may influence a channel for anywhere from tens to hundreds of years (Bryant 1980; Keller and Swanson 1979; Keller and Tally 1979; Megahan 1982), and the impacts of a mass debris flood movement event may last for decades, and probably much longer (Pearce and Watson 1983; Swanson and Dyrness 1975).

However, local water users are very concerned about the accumulation of “debris” within riparian channels, as they believe this impedes water flows and volume. As allowed under State regulations, the Mud Lake irrigators have been allowed to remove all “debris” and regenerating willows within refuge stream channels. Idaho statutes for the Alteration of Channels and Streams (Title 42; Chapter 38; 42-3806) states: “No permit shall be required by the state or any agency or political subdivision thereof, from a water user or his agent to remove any obstruction from any stream channel, if such obstruction interferes with, or is likely to interfere with, the delivery of, or use of, water under any existing or vested water right, or water right permit.” The Preferred Alternative (Alternative 2) and Alternative 3 would seek collaborative common ground solutions with the Mud Lake Water Users to ensure the rightful conveyance of Camas Creek waters to Mud Lake while restoring important riparian habitat processes, such as in-stream debris maintenance.

Wetland and Riparian Rehabilitation Plan. Increasing public concern regarding the sustainable development of river systems and the maintenance and enhancement of their biodiversity has resulted in the demand for the implementation of more environmentally sensitive and natural engineering works, and for the restoration of unstable and degraded rivers (Boulton 1999). Consequently, there is an urgent need to develop more appropriate channel design procedures that will not only preserve the natural stability of rivers but, by maintaining habitat diversity, also their ecological and amenity value. By designing with nature, rather than imposing a solution on the river, such approaches are likely to be sustainable and, therefore, more cost effective than traditional engineering solutions (Hey 2006; Rosgen 1994). Thus, practices to reduce, rather than eliminate, the channelization disturbance must be undertaken (Henderson 1986; Brookes 1988). Although still in its formative stages, restoration science for riparian ecosystems is growing rapidly, and progress is being made (Goodwin et al. 1997). There is not, and probably never will be, a universal approach to riparian restoration that is appropriate for all situations. The continuum of river and riparian environments is so extensive that Camas NWR should not seek universal solutions or transfer management approaches based on relations and concepts developed for other riparian systems (Schumm 1984).

In Alternatives 2 (Preferred Alternative) and 3, we propose to develop an integrated Camas NWR Wetland and Riparian Rehabilitation Plan (WRRP) and associated NEPA document by 2017. Riparian restoration requires the *a priori* specification of a set of physical and ecological conditions to be established at a restoration site. The WRRP would consider various alternatives for Camas Creek restoration, weigh the biological, cultural, economic, and social benefits and costs, and determine a future course of action supporting desired ecological outcomes. A three-tiered process would be used to develop the management plan: (1) identification of management objectives, and assessment of hydrologic, geomorphic, and biologic features associated with target riparian systems and associated wetlands; (2) Implementation of riparian/wetland pilot projects to evaluate biological and physical responses to management action, and assess the efficacy of management strategies; and (3) development of a decision support system to support an integrated wetland/riparian rehabilitation plan and associated NEPA document with refuge partners.

Alternatives 2 and 3 would provide a realistic timeline to complete and implement the rehabilitation plan within the lifetime of the CCP. The first two years would be spent collecting necessary information (geomorphological, hydrological, and biological assessments). Concurrently, the Refuge would implement and monitor rehabilitation pilot projects to gain a better understanding of system response to enhancement activities. By conducting pilot studies over the next four years (2014-17), the Refuge would better understand how the riparian system and adjacent wetland habitats may respond to larger scale rehabilitation efforts. Such pilot projects would have the advantage of being relatively low cost and reversible, and allow the Refuge to assess the efficacy of different approaches in meeting biological objectives before making a decision to pursue larger, long term projects. For example, a long term goal of increasing the frequency and duration of overbank flows could be accomplished by either raising the channel bottom or lowering the banks to their historic natural height. A pilot project to lower banks in strategic locations would allow the efficacy of this strategy in restoring overbank flows to be assessed. Using results from the pilot projects, a comprehensive plan would be crafted by 2017, and implementation of long-term rehabilitation efforts would be conducted from 2017-2027.

The objective of stream restoration proposed in Alternatives 2 and 3 is to restore natural geomorphic forms and processes and a sustainable fluvial ecosystem. Restoration of geomorphic form, however, does not necessarily restore geomorphic processes. Streams are complex geomorphic features (Schumm 1984), shaped and controlled by numerous internal and external processes and conditions. Like human beings, streams are singular or unique, even though all streams share many common characteristics (Schumm 1984). This combination of complexity and singularity means that restoring Camas Creek to some particular form does not guarantee that riparian processes would be reestablished (Goodwin et al. 1997).

Because riparian ecosystems are dependent on their watersheds, larger scale watershed and river basin approaches to restoration may be necessary to solve Camas Creek problems (DeBano and Schmidt 1989a,b, 1990; McGlothlin et al. 1988). These watershed changes may be manifested in the riparian zone by channel degradation, aggradation or widening, lowering of the alluvial groundwater table, and modifications to fluvial processes (Keller and Kondolf 1990; McGlothlin et al. 1988). In addition to watershed treatments, in-channel structures may be required to stabilize channels, reduce sediment, and extend the duration of streamflow (DeBano and Schmidt 1989). If the watershed cannot be restored, the stream channel and riparian zone must be rehabilitated to a state in equilibrium with the watershed’s ongoing water-sediment production regime (Brookes 1987; Morris 1995). While some of the stream systems and their associated meadow complexes have adjusted to the current hydrologic and sedimentologic regimes and are now in a quasi-equilibrium state, others are in a nonequilibrium state and are still actively incising. Consequently, return to pre-incision conditions is an unrealistic goal for these dynamic systems (Chambers and Miller 2011).

UPLAND HABITATS

Objective 1.5: Semi-Desert Shrub Steppe Habitat Management

(1.5a) For the life of the plan, maintain existing sagebrush-steppe habitat (2,623 acres) and *slightly increase* efforts to prioritize a *"triaged"* effort for rehabilitation and restoration of degraded uplands *as a subordinate priority* to the primary refuge emphasis for wetland management.

(1.6b) Over the life of the plan, *rehabilitate 113 acres* of degraded or altered upland sagebrush habitat on historic sagebrush sites impacted by wildfire or previously type-converted to agriculture, while conducting *experimental (<1 acre) test-plot treatments* to *increase plant diversity and habitat function* within *refuge areas dominated by crested wheatgrass.*

Benefitting Refuge Species:

Sage-grouse, sage thrasher, mule deer, elk, pygmy rabbit, Idaho pocket gopher, Brewer's sparrow, loggerhead shrike

Upland sagebrush habitat is characterized by the following attributes:

- Basin big sagebrush, in silty or sandy soils, with perennial bunchgrass understory
- Wyoming sagebrush in shallower drier soils, with perennial bunchgrass understory
- Fire frequency return-intervals from 50-100 years.
- 10-40% open to moderately dense canopy cover dominated by sagebrush or co-dominated by 5-10% antelope bitterbrush.
- Shadscale saltbush, green rabbitbrush, rubber rabbitbrush, horsebrush, or prairie sagewort may be common, especially in disturbed stands.
- >25% cover of native bunchgrasses (e.g., Indian ricegrass, plains reedgrass, streambank wheatgrass, Idaho fescue, rough fescue, prairie Junegrass, Sandberg bluegrass, and bluebunch wheatgrass) and forbs (i.e., Hood's phlox, sandwort, and milkvetch).
- <10% cover of invasive plants (e.g., Russian knapweed, cheatgrass)

Alternatives *Objective as written above is modified by replacing acres in italics with the text in this row.*	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
(1.6a) Sagebrush-steppe Restoration and Rehabilitation efforts:	Maintain	Slightly Increase	Dramatically increase
(1.6a) Restoration and Rehabilitation prioritization:	Case-by-case	Triaged	Extensive
(1.6a) Refuge management emphasis:	As a subordinate priority to wetland/riparian management		As a Co-equal priority with wetland/ riparian management
(1.6b) Treatment acres:	Rehabilitate 113 acres		Restore and Rehabilitate 425 acres
(1.6b) Restoration scale:		Experi-mental treatments	Ecological restoration

(1.6b) Restoration attributes:		Increase. habitat diversity, function	Increase ecological integrity
(1.6b) Restoration target area:		Areas dominated by crested wheatgrass	The Upper Snake ecosystem
Strategies Applied to Achieve Objective	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Opportunistically restore sagebrush in degraded habitats that have recently burned, or are in stable crested wheatgrass or cheatgrass monocultures.	✓	✓	✓
Prioritize wetland/riparian rehabilitation over upland habitat restoration. Should resources become available through agency funding, partnerships, etc., restore upland habitat using a strategic, "triaged" approach.		✓	
Initiate upland habitat restoration and wetland/riparian rehabilitation as an equal management priority.			✓
Implement experimental (<1 acre) test-plots to restore sagebrush within refuge areas dominated by crested wheatgrass.	✓	✓	✓
Facilitate the establishment and persistence of native grasses and forbs in non-native crested wheatgrass monocultures. • Decrease density of crested wheatgrass through appropriate treatments (mechanical, chemical, and fire), implemented singly or in combination, prior to introducing native grasses and forbs as seed or seedlings. • After treatment to reduce non-native grasses, inter-seed native grasses and forbs with a standard rangeland drill, minimal till drill where less soil disturbance is desired (e.g., Truax or Brillion), or deep-furrow rangeland drill (for deeper sod forming soils). • Transplant "wildlings" from existing native populations or propagated bareroot or container stock. • Document all implementation practices (e.g., spatial and temporal considerations, conditions, techniques, equipment).	✓	✓	✓
Monitor plant diversity in the sagebrush restoration areas annually for the first post-restoration year and every 2-3 years thereafter to measure the effectiveness of treatments and provide a framework for adaptive management to improve restoration practices in the future.	✓	✓	✓
Minimize public use and management activities that disturb the soil surface (e.g., grading of road shoulders or use by OHVs) which may increase spread of invasive species into sagebrush habitats.	✓	✓	✓
Rehabilitate sagebrush sites impacted by wildfire through Emergency Stabilization and Rehabilitation (ESR) and Burned Area Emergency Response (BAER) or refuge force-account funds. Evaluate wildfires as soon as possible to determine if re-seeding is necessary to achieve habitat management objectives. If needed, plant sagebrush seedlings to increase sagebrush succession in burned areas with high sagebrush mortality. Re-seed herbaceous understory with native bunchgrasses and forbs whenever possible. Ensure post-fire	✓	✓	✓

activities do not remove or burn any remaining patches of sagebrush within the fire perimeter.			
Enhance the development of partnerships for design and implementation of sagebrush conservation and restoration efforts.	✓	✓	✓
Coordinate sagebrush management actions and treatments with State WMAs, IDFG, BLM, Tribe, and the USFS as partnering agencies and land management entities.	✓	✓	✓
Cooperatively share restoration techniques and ideas with partnering agencies and land management entities (e.g., Mud Lake and Market Lake Wildlife Management Areas, BLM, Tribes, IDFG, USFS).	✓	✓	✓
Reduce the size, intensity, and frequency of wildfires by identifying and implementing an active refuge fire suppression response in identified functional high priority sage-grouse habitat.		✓	✓
Do not implement prescribed fire in sage-grouse habitats prone to invasion by cheatgrass and other invasive weed species unless adequate measures are included in restoration plans to replace the cheatgrass understory with perennial species using approved reseeding strategies. These strategies could include, but are not limited to, use of pre-emergent herbicides (e.g., Oust®, Plateau®) to retard cheatgrass germination until perennial herbaceous species become established.		✓	✓
Restrict prescribed fire occurrence >200 meters (m; 656 feet) from riparian and wet meadows and limit fire size to not exceed a one-time occurrence of >120 acres or 20% of the total refuge winter sage-grouse habitat within any 20-30 year interval, unless other compelling reasons warrant larger areas. In those cases, the reasons should be thoroughly justified in the analysis. Removal of sagebrush should be avoided.		✓	✓
Work with the representative agencies that constitute the Upper Snake Sage-grouse Local Working Group to create a useable habitat map and Geographic Information Systems (GIS) database of the Upper Snake area that identifies: leks; nesting and early brood rearing habitat; summer brood rearing habitat, winter habitat; and migration corridors/linkage areas.		✓	✓
Evaluate the anticipated responses and model the trajectory of sagebrush communities to human-associated disturbances across the Upper Snake regional ecosystem as the basis for spatial prioritization of landscape scale management.		✓	✓
Establish spatial priorities, across the regional sagebrush ecosystem within the Upper Snake Sage-grouse Local Working Group by estimating and inventorying resistance and resiliency of sagebrush communities for best uses of limited resources for maintenance of current conditions, and restoration of desirable conditions.		✓	✓
Prioritize habitat management actions to occur within: 1. Existing habitats, in occupied sage-grouse range, that have moderate or high potential to be maintained; 2. Former habitats, in occupied sage-grouse range, that have moderate or high potential to be restored, and that are adjacent to or close to areas with moderate or high potential to be maintained; and		✓	✓

3. Existing habitats, in occupied sage-grouse range, that have low potential to be maintained.			
Implement preventive treatments in priority areas that are vulnerable to wildfire to reduce potential large-scale losses of sage-grouse habitat by: 1. Identification for potential for wildfire occurrence based on history, human use patterns, and fuel loading; 2. Potential for wildfire ignition, difficulty of suppression, potential suppression tactics, and potential acreage of burns; and 3. Minimizing the acreage that is vulnerable to wildfire by implementing preventive treatments (i.e., mechanical, physical, and chemical) to reduce fine and woody fuel loads and the risk of catastrophic wildfire.		✓	✓
Estimate the resources and budgets required to fully address extensive participation and coordination of landscape spatial sagebrush restoration and management priorities within the Upper Snake region.		✓	✓
Formulate a regional approach to sagebrush conversation by contacting landowners in key habitat areas to explain sage grouse needs and seek their support for improving sage grouse habitat. Meet with groups and agencies that work with private landowners to explain and seek support for actions outlined the Idaho Sage-grouse Management Plan (1997) and Upper Snake Sage-Grouse Local Working Group Plan for Increasing Sage-Grouse Populations (2009).		✓	✓
Restore degraded sagebrush areas (areas with undesirable vegetation and areas in poor ecological condition) with a desired mix of grasses, forbs, and shrubs so they again can become usable habitat for focal sage-obligate species, by: 1. Mechanically, physically, or chemically decrease sagebrush cover in areas predominately shrub dominated (shrub dominated state/late seral) and of low risk for invasive species establishment. 2. Inter-seed native grass (broadcast/harrow, but preferably shallow drilling with a rangeland drill) and native forbs (seed or head-started seedlings) to increase diversity within the herbaceous understory.		✓	✓
Use IPM strategies including chemical, mechanical, horticultural, and biological control agents to control/eradicate invasive plants (see Appendix F).	✓	✓	✓

Rationale, Objective 1.5: Semi-Desert Shrub Steppe Habitat Management:

Shrub-steppe habitat is the least variable of all refuge habitat types, but complements the wetland complex by providing additional habitat for upland nesting wildlife. Additionally, shrub habitats provide winter cover for big game species such as moose and mule deer, while serving as the primary habitat type used by specialists such as sage-grouse.

The sagebrush (*Artemisia* spp.) ecosystem once occupied over 150 million acres of western North America (Barbour and Billings 1988). The ecosystem still occupies over 100 million acres (Connelly et al. 2004; Wisdom et al. 2005a), but the abundance and condition of sagebrush communities is declining rapidly in response to a variety of detrimental land uses and undesirable ecological processes (Knick et al. 2003). Since Euro-American settlement, this ecosystem has been reduced in area by 40-50% (Connelly et al.

2004), and less than 10% remains in a condition unaltered by human disturbances (West 1999). Numerous anthropogenic threats have reduced the abundance, quality, and contiguity of sagebrush ecosystems. Wisdom et al. (2005a) identified 26 threats to sagebrush habitats and species that operate at regional scales, and thus affect, or have potential to affect, areas the size of a county, multiple counties, or even a state. The varied range of threats—including climate change, exotic plant invasions, roads to transmission lines, urban development, and overgrazing by livestock—shows that no single factor or process is responsible for the ecosystem's problems.

Currently the Refuge contains 2,623 acres of sagebrush-steppe (primarily Basin big sagebrush) habitat, which includes about 470 acres of green rabbitbrush shrubland. (Green rabbitbrush shrubland is considered an early successional stage, with sagebrush being the climax community). Over time, more than half of the sagebrush habitat at Camas NWR has been highly degraded by altered fire regimes, past livestock grazing, and invasive species. The total current acreage of upland non-native plant communities, which were historically either sagebrush-steppe or native grassland, is 1,114 acres. Most of this area (984 acres) is dominated by crested wheatgrass monocultures which have relatively low value to wildlife. The condition of the Refuge's remaining sagebrush and green rabbitbrush plant communities are variable. Some relatively high quality stands remain, that are far superior to any shrub habitat on adjacent private land, while other areas have a high percentage of non-native grasses and forbs in the understory.

Before undertaking broad restorative efforts, Alternatives 2 and 3 call for inventories to determine which sagebrush communities are currently resistant and resilient, versus those that have low resistance and resilience, as well as those with characteristics intermediate to these extremes (Wisdom et al. 2005b). Healthy sage-steppe communities are defined as "resistant" when the ecosystem maintains its structural and functional attributes in the face of stress and disturbances. "Resilience" describes the ability of an ecosystem to regain structural and functional attributes that have suffered harm from stress or disturbance. Current knowledge suggests that little can be done to restore vast areas of sagebrush that have already been lost and experienced threshold effects that are impossible, or highly improbable, to reverse (Bunting et al. 2002). On the other hand, many areas of existing sagebrush that are close to transitioning to undesirable, irreversible habitat conditions (e.g., cheatgrass) might be prevented from transitioning through management intervention. Still other areas of sagebrush are highly resistant and resilient to most human disturbances, and would require less management intervention to retain native components and processes.

Under all alternatives we would use a suite of strategies (physical, mechanical, and chemical treatments) to attain desired vegetative conditions on either existing or restored upland habitats. Restoration is typically thought of as one or more actions that move an ecosystem from its current degraded set of conditions toward a target, or reference, set of conditions (SER 2002). In contrast to this "active" restoration, "passive" restoration entails eliminating the source of the disturbance that resulted in degraded conditions, protecting that ecosystem from other disturbances, and allowing the ecosystem to recover on its own and at its own pace (DellaSala et al. 2003; Kauffman et al. 1997). Some existing refuge sagebrush communities are highly resilient and resistant, and therefore at low risk from disturbance and transitioning to an undesirable state. These communities are better managed and maintained in their current state, as proposed in Alternative 1. The passive approach is exemplified in Alternative 1 (Current Management). Alternative 1 would rely on maintenance and protection of existing uplands through invasive species containment and limiting access. In most cases previous protective and passive restrictions, such as eliminating livestock grazing from the Refuge in 1994, have greatly enhanced upland habitats, facilitated regeneration in previously disturbed areas, and minimized the need for active management.

However, in some areas past grazing impacted sagebrush shrub habitat to the point where transitional thresholds were reached and degraded habitats are now dominated by late successional sagebrush with little grass or forb understory. These areas are now at risk from catastrophic wildfire and conversion to an annual cheatgrass state. It is highly unlikely that small refinements in current management practices will maintain existing, desirable conditions in areas where sagebrush communities have low resistance and resiliency (Hemstrom et al. 2002). Many sagebrush communities that have intermediate levels of resistance and resiliency require restoration and active management, as identified in Alternatives 2 and 3, to prevent undesirable transitions that are likely to occur under current management (Alternative 1). Active restoration (as proposed in Alternatives 2 and 3) would be required to restore these altered habitats.

Alternative 3 would seek to both prevent undesirable transitions of community type, and restore relatively large areas of degraded sagebrush habitat on the Refuge. Implementation of this alternative would require comprehensive and effective management of all human-associated disturbances that operate at broader scales in the sagebrush ecosystem. If all human-associated disturbances were effectively managed, as proposed in Alternative 3, many existing sagebrush communities might be maintained, and some former sagebrush-steppe communities within the Upper Snake ecoregion would have a better chance of being restored. To focus mitigation on some threats, but ignore many other threats, is a strategy likely to fail when applied at the landscape scale across expansive areas that typically experience a wide variety of disturbances (Wisdom et al. 2005a).

However, the funds needed to fully implement all prescriptions on regional sagebrush ecosystems are scarce, and considerations of current natural resource management budgets makes implementation of Alternative 3 difficult at best (Wisdom et al. 2005b). Unless budgets substantially increase for public land managers of sagebrush, there simply are not enough resources to maintain all current sagebrush communities, let alone recover a portion of communities lost. In the Interior Columbia Basin, Hemstrom et al. (2002) and Wisdom et al. (2002) found that even a six-fold increase in the budgets of the U.S. Department of Interior Bureau of Land Management and U.S. Department of Agriculture Forest Service for sagebrush maintenance and restoration reduced the rate of decline in habitat loss and quality, but did not reverse the decline. Notably, Hemstrom et al. (2002) and Wisdom et al. (2002) focused their management scenarios on restoration of former sagebrush sites, with less emphasis on maintenance of existing communities; increased emphasis on maintenance would likely have resulted in more effective outcomes. Regardless, the findings of these authors demonstrate that a dramatic funding increase is required to realistically expect a reversal in the accelerating loss of both area and quality of sagebrush habitats. Consequently, an appropriate concept of “triage” would be implemented according to a system of priorities designed to maximize habitat function (Wisdom et al. 2005b). Prioritizing, or “triaging” areas for habitat management in occupied sage-grouse range which have moderate or high potential to be maintained concentrates management where populations of sagebrush focal species are largest and declining least (Connelly et al. 2004). Finally, these are the areas most likely to be maintained under current refuge budget and resource constraints.

If the Refuge were to select Alternative 3, which elevates upland habitat restoration as a coequal to wetland/riparian rehabilitation, as the Preferred Alternative, upland habitat restoration would likely compete with wetland and riparian restoration for limited resources (refuge staff time, grant opportunities, and partnership involvement). Such an approach would be analogous to fighting a war on two fronts (Wu et al. 2000), possibly compromising the success of either effort (Botrill et al. 2008; Mackenzie 2008). Therefore, Alternative 2, which prioritizes wetland/riparian rehabilitation while moving forward strategically with a degree of upland habitat rehabilitation efforts, was selected as the Preferred Alternative in this CCP. Alternative 2 allows flexibility in the amount of progress that is made in upland habitat restoration, depending on the availability of resources and results of pilot habitat restoration projects. Alternative 2 would use optimal decision-making tools to indicate the best allocation of resources to achieve conservation objectives.

Restoration of native sagebrush-steppe communities in crested wheatgrass monocultures. Crested wheatgrass was widely introduced to the Intermountain regions of North America to improve the condition of degraded rangelands (Pellant and Lysne 2005). It proved to be a successful revegetation species due to its superior ease of establishment, strong competitive ability, and grazing tolerance (Monsen 2004). Crested wheatgrass forms large homogeneous stands lacking the sagebrush and plant species diversity required for sage-obligate species (Crawford et al. 2004; Heidniga and Wilson 2002). Once established, crested wheatgrass can quickly dominate the seedbank and hinder recruitment and growth of native species (Henderson and Naeth 2005; Marlette and Anderson 1986), thereby forming nearly monotypic stands. Crested wheatgrass is also reported to resist invasion by nonindigenous forbs and annual grasses (Berube and Myers 1982; D'Antonio and Vitousek 1992; Sheley et al. 2008).

The best methods to suppress crested wheatgrass in order to establish sagebrush should be based on the most current scientific literature and knowledge (Pehrson and Sowell 2011). Crested wheatgrass cover must be reduced for sagebrush to be seeded and successfully established. While no one technique has proven to eliminate crested wheatgrass in a single application, strategies to increase native plant diversity in crested wheatgrass stands need to address all three causes of succession (site availability, species availability, species performance). Furthermore, treatments to suppress crested wheatgrass need to be applied at the most opportune time and may need to be repeated prior to introducing native species (Fansler and Mangold 2010). Subsequent management that favors the persistence of native species and retards crested wheatgrass is critical. Otherwise, attempts to control crested wheatgrass and establish native species would lead to failure and lost investments. Treatments that address species performance should be considered in future research projects. Repeated treatments or combinations of treatments may be necessary to reduce crested wheatgrass biomass and increase the establishment of native seeded species (Pellant and Lynse 2005). Achieving shrub densities of 1 shrub/m^2 (1 shrub/11 square feet) would be acceptable; however, 1.2 to 1.4 shrubs/m^2 (1.2 to 1.4 shrubs/11 square feet) would provide better habitat for most shrub-dependent species, such as sage-grouse (Woodward 2006).

Applying seed with a rangeland drill is considered the best method for establishing species with large, hard seeds because the seed is placed in contact with the soil and at an appropriate depth (Hull 1948; Pyke 1994). However, seeding many native species with the standard rangeland drill is problematic given the lack of control of seeding depth, variable seed coverage with soil, and absence of a mechanism to improve soil to seed contact. Surface obstructions such as rocks, steep slopes, and soddy vegetation also limit the effectiveness of rangeland drills in establishing any seed mixture, especially native forbs and grasses. One unknown in the use of rangeland drills is the effectiveness of these drills in cutting through dead plant crowns and shallow root masses. If this is a problem, the Refuge has developed management strategies in Alternatives 1, 2, and 3 for the use of a deep furrow rangeland drill (Hull and Stewart 1948), which has a double furrow opener, which may be more effective in soddy conditions than the rangeland drill, which has a single furrow opener. The single disk or double disk opener on the rangeland drill does create a furrow that can capture and store water for seedlings. However, the soil disturbance created by this drill also opens the plant community for the entry of other invasive species. It may not be possible or feasible to evaluate seeding success or failure until at least eight years after initial seeding (Schuman et al. 2005). However, the benefits of increasing plant diversity in crested wheatgrass monocultures would include improved aesthetics, more soil cover (Stevens 1994), and increased diversity of birds, mammals, reptiles, and insects (Reynolds 1980).

GOAL 2: Naturalized Habitats

Provide high quality forage and cover habitat to increase fitness (e.g., physical condition, survival, reproduction) of migratory birds.

Objective 2.1: Shelterbelt Habitat Management

(2.1a) *Maintain 34 acres* of naturalized shelterbelt habitat *in current location* with *partial groundwater flooding irrigation and micro-irrigation* using *additional supplemental funding sources, other than refuge force-account base funds.*

(2.1b) Annually re-plant *10-15%* of mature cottonwoods within the existing shelterbelt stand lost to drought or old age, and annually restore *1-5%* of the understory to native Idaho tree and shrub species.

Benefitting Refuge Species:

Breeding: Willow flycatcher, dusky flycatcher, yellow warbler
Migrants: Wilson's warbler, yellow-rumped warbler, ruby-crowned kinglet, Mac Gillivray's warbler
Wintering: Bald eagle

Shelterbelt habitat is characterized by the following attributes:

- Introduced and naturalized plains cottonwood.
- >40% canopy cover of mature (>60 feet tall) and >20% early-mid successional (<60 feet tall) cottonwood.
- <15% cover of understory exotic shrubs (i.e., Siberian pea, Russian olive) that are <18 feet in height
- >35% cover of native understory shrubs and trees (i.e., blue elderberry; black hawthorn; chokecherry; silver buffaloberry; skunkbush sumac; Wood's rose; red osier dogwood; American plum)
- Occasional overbank flooding and sediment deposition, for cottonwood seed dispersal and regeneration.
- <5-10% cover of invasive plants (e.g., cheatgrass, Canada thistle, musk thistle, smooth brome grass)

Alternatives *Objective as written above is modified by replacing acres in italics with the text in this row.*	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
(2.1a) Management action:	Maintain 34 acres		Expand by 15 acres
(2.1a) Shelterbelt location:	In current location		Along periphery of existing stand
(2.1a) Irrigation:	Ground-water irrigation	Partial groundwater flooding and micro-irrigation	Ground-water irrigation
(2.1a) Funding sources for implementation:	Refuge force-account	Additional supplemental funding	Force-acct +suppl funding

(2.1b) Replacement of mature cottonwood overstory:	5-10% annually	10-15% annually	20-25% annually
(2.1b) Restoration of native understory:	5-10% annually	1-5% annually	10-20% annually
Strategies Applied to Achieve Objective	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Pump groundwater and flood irrigate shelterbelt habitat with existing ditch and water delivery network to irrigate shelterbelt habitat.	✓		
Re-design water delivery system and re-configure groundwater pumps to flood irrigate shelterbelt habitat and mimic natural floodplain processes in units with water management capabilities promote native seed germination and to control invasive plants.		✓	✓
Develop micro-irrigation system and renewable solar energy powered water delivery system to supplement groundwater flood irrigation to irrigate and establish new plantings.		✓	
Prepare planting or re-planting sites with an individual or combination of manual, mechanical, prescribed fire, herbicide treatments to improve planting success by improving site conditions suitable for high seedling survival and rapid growth.		✓	✓
Initiate habitat management treatments to establish suitable light, moisture, and nutrient conditions to naturally release young trees from competition from ground or canopy competition.		✓	✓
Between 2014 and 2017 initiate pilot project to lower the banks of Camas Creek on the Refuge (See Riparian Habitat Objective 1.4) in strategic locations, as consistent with Idaho Water Law, to increase the occurrence of natural overbank flooding for shelterbelt habitat.		✓	✓
Seek grants and other funds to provide shelterbelt trees and shrubs and materials and supplies to maintain shelterbelt habitats on a sustained basis.		✓	✓
Endorse and formulate partnerships with public and private agencies and adjacent landowners to maintain and enhance connectivity of Regional farm and ranch shelterbelt habitat quality on adjoining lands.		✓	✓
Re-initiate landbird banding and monitoring station to inventory and monitor spring/fall migrant use and phenology of shelterbelt habitat use.		✓	✓
Develop propagation techniques and program for cottonwood and native riparian trees and shrubs for out-planting on the Refuge and adjoining shelterbelts.			✓
Annually plant an additional 800 m^2 (8,611 square feet) (20 × 40 m [66 × 131 feet]) area of cottonwood saplings on the peripheral edge of the existing shelterbelt stand, adjacent to current irrigation capabilities.			✓
Maintain processes which allow natural succession of early successional shelterbelt to advance into mid-late succession stage habitat. It is estimated that approximately 16 acres of early successional shelterbelt would achieve mid-successional characteristics over the lifetime of the CCP.	✓	✓	✓
Protect plantings from rodent and deer damage by planting small trees in protective plastic tubing, rodent and deer proof fencing, and rodent repulsion chemicals.	✓	✓	✓
Replace non-native and/or invasive trees and shrubs (i.e., Russian olive, Siberian pea) with trees and shrubs native to Idaho that provide similar habitat and food values for migratory birds.	✓	✓	✓

Enlist the help of volunteers and other special interest groups to help provide labor for planting and maintenance of plantings on a case by case basis.	✓	✓	✓
Allow cottonwood snags (standing dead trees) and fallen dead limbs to remain unless they pose an immediate danger to the public or refuge facilities, or inhibit natural or assisted regeneration of young cottonwoods.	✓	✓	✓
Use IPM strategies including mechanical, physical, biological, and chemical means to eradicate, control, or contain invasive and undesirable plants (see Appendix F-IPM Program)	✓	✓	✓

Rationale, Objective 2.1: Shelterbelt Habitat Management:

Shelterbelts (also known as windbreaks) generally consist of rows of shrubs and trees planted on the windward side of farmstead dwellings (Yahner 1983). Field windbreaks are similar plantings also designed to reduce wind erosion of agricultural land (Goldsmith 1976). They became common in the 1930s in order to prevent wind erosion on American farmlands. The Food Security Act of 1985 approved shelterbelts as a cover type for areas not being farmed. Today, farmers participating in the Conservation Reserve Program (CRP), sponsored by the United States Department of Agriculture (USDA), receive rental payments for land used to support shelterbelts and cost-sharing for planting trees and shrubs. Only 34 acres (less than 1 percent) of the total 10,806-acre Refuge is shelterbelt habitat. The cottonwood trees around the headquarters site were planted as windbreaks when the Refuge was commissioned in 1937. The tall canopy trees are Plains cottonwoods, and the shorter sub-canopy trees and shrubs are predominantly native coyote (narrowleaf) willow, and non-native Russian olive and Siberian pea.

However, this small area is extremely important to migratory landbirds. Eastern Idaho birders have recognized the wooded area at Camas NWR as a migration hotspot for decades. Increased birding attention in the past decade has yielded numerous sightings of birds never previously documented in Idaho. Carlisle et al. (2008) documented an impressive abundance and diversity of spring and autumn migrants using both the Refuge and the Market Lake and Mud Lake WMAs. Seventy-four different songbird species were captured at the Camas NWR headquarters shelterbelt. Additionally, one of the shelterbelts at the headquarters site has become a favorite overnight roost for wintering bald eagles. According to refuge records, as many as 85 eagles have been counted in these trees in a single evening, with an average of about 40.

However, a long-lasting drought and increased agricultural use of groundwater in the region has resulted in lowered groundwater levels and low streamflows along Camas Creek, the main source of water for the Refuge. This has resulted in extensive mortality of mature trees in the refuge headquarters area. In addition, many of the trees around headquarters are at the end of their life span. Replacement in some areas has been initiated and is proving to be time, labor, and money intensive. With the lowering of the water table, new tree plantings must now be cared for diligently and funds must be committed to irrigate them for several years, until their root systems are well established.

In all alternatives, existing naturalized shelterbelt habitat would continue to be maintained to provide habitat for migratory landbirds and maintain quality wildlife viewing opportunities. The alternatives differ in the rate of replacement and the use of groundwater versus drip irrigation. Under Alternative 1 we would replace 5-10 percent of mature trees near the end of their life-span annually. Annually 5-10 percent of non-native understory trees and shrubs would be replaced with native species. Alternative 1 would continue to use surface water diversions and groundwater pumping to surface irrigate shelterbelt habitats. Surface irrigation has proven to be an appropriate choice in porous soils (final infiltration rates over 7 cm [2.8 inches]/hour), such as the sandy soils on the Refuge (Letey 1985; Sijali 2001). Although surface irrigation can be efficient (70 percent or more), in the Refuge's situation only half of the applied water reaches the plant because of poor irrigation infrastructure.

Alternative 2 (Preferred Alternative) would manage shelterbelt habitats similar to Alternative 1, but increase efforts to replace mature cottonwoods from 5-10 percent to 10-15 percent annually. The Refuge would reduce the rate of non-native understory plantings from 5-10 percent to 1-5 percent annually. Native tree plantings would be irrigated with a new system of renewable energy drip irrigation in the same location (34 acres) where current shelterbelt groundwater irrigation capabilities exist. However, additional supplemental funding sources would need to be secured to implement Alternative 2, since the Refuge would not use refuge base funds to initiate replacement of tall mature cottonwood trees or native understory trees and shrubs.

In Alternative 3, the Refuge would dramatically increase cottonwood overstory rehabilitation from 5-10 percent in Alternative 1, to 20-25 percent annually in Alternative 3. Non-native understory replacement with natives would increase as well, from 5-10 percent in Alternative 1, to 10-20 percent in Alternative 3. Extensive groundwater irrigation would be used to reduce mortality of mature trees and increase survivability of planted trees. The Refuge would use both base and outside funding sources to expand this habitat by 36 acres to 50 acres (a 40 percent increase).

Stop-over ecology data provides documentation that the majority of refuge migrants were able to gain mass during stop-over at Camas NWR within mixed native/non-native vegetation (Carlisle at al. 2008). This suggests that, either in spite of or with the help of non-native vegetation, migrants are able to stop-over successfully in these oases. Hudson (2000) examined fall migrant abundance and diversity in willow (native) and Russian olive (non-native) habitats in the Columbia River basin and found that species richness was greatest in willow but that different suites of species showed higher abundances in willow versus olive habitats. In particular, short distance migrants such as yellow-rumped warbler and white-crowned sparrow were more common in Russian olive whereas neotropical migrant species such as orange-crowned, yellow, and Wilson's warblers, were more common in willow habitats (Hudson 2000). These data stress the importance of native riparian habitats but also suggest that Russian olive habitats can be important to certain migrant species. At Camas NWR, non-native species such as Russian olive and Siberian pea provide much of the cover available to migrants during stop-over and their importance has been recognized. Therefore the systematic long-term approach of Alternative 2, to gradually restore 1-5 percent of the non-native vegetation per year with native trees and shrubs, versus the more rapid approaches proposed in Alternatives 1 and 3, is not only warranted but likely to result in positive effects to migratory landbirds.

In the Preferred Alternative (Alternative 2) drip or trickle irrigation the water would be applied to the soil through small-sized openings in a small (0.5- to 1-inch) irrigation pipe laid directly on the soil surface or buried in the soil. By applying water at a very slow rate, drip irrigation is capable of delivering water to the roots of individual trees or plants as often as desired and at a relatively low cost. Because drip irrigation makes it possible to place water precisely where and when needed with a high degree of uniformity and efficiency (90 percent or more) the method is useful under many field and water situations. Losses to runoff, deep percolation and evaporation are minimal (Sijali 2001) which means that most of the irrigation water is taken up by the plant.

To a large extent, soil texture determines the survival and growth rate of each species. Cottonwood trees grow rapidly in soils that have a high proportion of sand. Soil texture is critical to plant survival and growth because the soil particle sizes determine the water holding capability. Large particles such as sand allow water to drain quickly and cannot hold water for extended periods. Refuge soils are predominantly sandy and will not allow for the use of flood irrigation due to rapid drainage, so a drip-irrigation system will be required (Griggs 2009). The installation and application of micro-drip irrigation in Alternative 2 would greatly enhance survival of tree plantings, while simultaneously conserving water.

In the Great Plains, the width of shelterbelts is very important in determining the value for wildlife (Podoll 1979). Snow drifts commonly penetrate up to 30 m (98 feet) into shelterbelts, and belts less than this width have less value for wildlife in winter. Multi row shelterbelts where shown to provide winter cover for ring-necked pheasants, gray partridge, sharp-tailed grouse, cottontail rabbits, fox squirrels, and songbirds, while single-row belts provide winter cover for only the gray partridge. In the Great Plains States, multi row shelterbelts also provided both escape and loafing cover for white-tailed deer. The best configuration of multi row shelterbelts for wildlife is to have tall trees in the middle rows and lower shrubs in the outer rows of the belt.

Cassel and Wiehe (1980) analyzed breeding bird counts from 81 shelterbelts in North Dakota; these data indicate that individual shelterbelts with a large number of rows (>20) contained more breeding birds per belt than did individual shelterbelts with ~20 rows. Belts with only a few rows attracted more birds associated with open habitats, whereas belts with many rows attracted more birds associated with forested habitats. The highest bird species diversity in a study of South Dakota shelterbelts occurred in shelterbelts with a developed tree canopy and an understory with a full, lush grass layer (Martin and Vohs 1978). Dense shrub growth under the trees was not preferred, although tall, dense shrubs along the outside edges of shelterbelts increased the number of bird species using the shelterbelt. In Minnesota shelterbelts, vegetative variables that were positively correlated with total bird species richness for all seasons were stem density of canopy vegetation, mean diameter of trees at breast height, total basal area, percent canopy closure, and growth form diversity (Yahner 1983). The complexity of the vegetative structure was a major factor in determining bird community structure in shelterbelts, with older belts having more mature plant communities and greater bird species richness. While all alternatives would increase the complexity of vegetative structure over time, Alternative 3 would increase complexity at the fastest rate, and in addition the addition of shelterbelt habitat at the edge of existing plantings would increase the effective width of shelterbelt habitat.

GOAL 3: Agricultural Habitat

Provide a supplemental on-Refuge forage base for carbohydrate and protein requirements of migratory waterfowl and landbirds within the Pacific and Rocky Mountain migratory corridors.

Objective 3.1: Small Grain (Wheat and Barley) and Legume (Alfalfa) Management

(3.1 a) Annually work within existing Cooperative Land Management Agreements to maintain *20 irrigated acres of upland habitats as small-grain (wheat or barley*) in the Well #7 Field for wildlife forage, in rotation with *60 acres of legumes (alfalfa).*

(3.1b) Annually *work within existing Cooperative Land Management Agreements* to *maintain* *80 irrigated acres of legumes (alfalfa*) in the *Well #9 Field* for *wildlife forage*.

(3.1c) *Acquire refuge irrigation equipment* within 2 years of Well #9 Field should cooperative farmer remove personal irrigation equipment and continue to maintain *80 acres of irrigated acres of legumes (alfalfa)* in the Well #9 Field.

(3.1d) Modify the Well #9 Field objective (3.1c) from 80 acres of irrigated alfalfa to farm *20-40 dryland acres of upland habitats as small-grain (wheat or barley*) and *20-40 dryland acres of legumes (alfalfa)*, should the Refuge be unable to acquire replacement irrigation equipment.

Small Grain (Wheat and Barley) Benefitting Refuge Species:

Canada goose, mallard, greater sandhill crane, greater sage-grouse.

Small Grain (Wheat and Barley) Agriculture is characterized by the following attributes:

- Supplemental and artificial habitat maintained through agricultural management to provide small grain forage for wildlife use.
- Small grain, such as fall wheat or spring barley, planted in rotation with alfalfa (2 years grain followed by 6 years in alfalfa).
- <10% cover of invasive plants (e.g., musk thistle, Canada thistle, and smooth brome)

Legume (Alfalfa) Benefitting Refuge Species:

White-faced ibis, Swainson's hawk, long-billed curlew, Canada goose, mallard, greater sandhill crane, greater sage-grouse

Agriculture is characterized by the following attributes:

- Supplemental and artificial habitat maintained through agricultural management to provide leafy browse forage for wildlife use.
- Alfalfa height <6" by October 1
- Sustained green browse through migratory spring and fall seasons.
- Newly planted alfalfa fields with >75% cover of established alfalfa in first year.
- Rotational plantings of alfalfa and small grains (2 years grain followed by 6 years in alfalfa).
- <10% cover of invasive plants (e.g., musk thistle, Canada thistle, and smooth brome)

Alternatives *Objective as written above is modified by replacing acres in italics with the text in this row.*	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
(3.1a) Well #7 Field acres planted annually through CLMA	Small Grains: 20 irrigated acres Alfalfa: 60 irrigated acres		

(3.1b) Well #9 refuge management agreement:	Work within existing Cooperative Land Management Agreement		
(3.1b) Well #9 refuge management action:	Maintain		Restore
(3.1b) Well #9 refuge crop or habitat type:	80 acres alfalfa		80 acres native sage-steppe
(3.1b) Well #9 refuge crop or habitat type purpose:	Wildlife forage		Sagebrush obligate wildlife
(3.1c) Well #9 Irrigation equipment should cooperative farmer remove personal irrigation equipment:		Acquire refuge irrigation equipment	
(3.1c) Well #9 refuge crop, should cooperative farmer remove personal irrigation equipment:		80 acres alfalfa	
(3.1d) Well #9 Contingency objective should Refuge be unable to acquire irrigation equipment:		20-40 acres dryland small grains 20-40 acres dryland alfalfa	
Small Grain (Wheat and Barley) Strategies Applied to Achieve Objective	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Use Cooperative Land Management Agreements (CLMAs) with local farmers to implement the refuge farming program. Require Cooperators to front the cost of small grain operations (e.g., mechanical preparations, watering, seeding, labor costs) in exchange for harvesting a portion of the refuge alfalfa crop.	✓	✓	✓
Rotate crops after 2 years of being planted to small grain into a 6-year alfalfa planting.	✓	✓	✓
Annually evaluate workforce needs as indicated in the Camas NWR Annual Work Plan, to determine the efficacy of CLMAs in comparison to the Refuge undertaking agricultural plantings through force-account funding.		✓	
Should the current cooperative farmer decide to no longer farm the Refuge and remove his irrigation equipment, transition from the irrigated CLMA acres identified in objective 3.1a to dry land force-account acres identified in Objective 3.1b.		✓	
Reduce application of water for agricultural irrigation and increase water availability for wetland habitat management by taking the Well #9 field out of production for agriculture irrigation.			✓

Rehabilitate native sage-steppe habitat in the Well #9 field by restoring 20 acres to sage-steppe every 2 years (80 acres rehabilitated by 2020).			✓
Seek and develop partnership opportunities, and associated grant acquisition, to minimize overhead costs of agriculture management and infrastructure.		✓	✓
Annually survey and monitor wildlife use within refuge agriculture crops to assess benefits or impacts from the refuge farming program for wildlife.		✓	✓
Conduct periodic soil tests and work with cooperative farmer to apply proper fertilization and liming treatments, as necessary, to maintain proper nutrient and pH levels for productive agriculture plantings.		✓	✓
Amend soil and fertilize small grain crops by broadcasting granular nitrogen fertilizers on small grains during planting or prior to barley jointing.	✓	✓	✓
Prohibit applications of anhydrous ammonia fertilizer to minimize the presence of excessive environmental N accumulations and concerns for refuge soil and water resources.		✓	✓
Initiate small grain planting before irrigation of alfalfa begins to conserve water resources and irrigate planted small grain in conjunction with alfalfa.	✓	✓	✓
Apply lime 6 months before the actual planting date to affect soil pH by planting time.	✓	✓	✓
Attempt to till and plant across the slope, rather than with the slope of the land to reduce erosional forces on soil.		✓	✓
Use conservation tillage practices and avoid fall tillage for spring plantings. Initiate planting immediately after plowing and disking of small grain fields to lessen the amount of soil lost to wind erosion.		✓	✓
Plant small grain crops in blocks of rows running perpendicular to one another to ensure that the tops of some rows would be exposed by the prevailing winds during heavy snow.		✓	✓
Mow strips of small grain crops as they mature in the late summer or early fall to provide forage base for migrating birds. Leave a combination of standing small grain crops and mowed small grain crops (without harvest), to provide wildlife with suitable forage.	✓	✓	✓
Mow wide swaths of mature small grain crops, separated by several rows of unharvested crops, thereby providing a “snow fence” to enhance the availability of grain on the ground as well as provide a reserve of food that would remain above even the deepest early snows.		✓	✓
Legume (Alfalfa) **Strategies Applied to Achieve Objective**	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Use Cooperative Land Management Agreements (CLMAs) with local farmers to implement the refuge farming program. Require Cooperators to front the cost of small grain operations (e.g., mechanical preparations, watering, seeding, labor costs) in exchange for harvesting a portion of the refuge alfalfa crop.	✓	✓	✓

Rotate crops after 2 years of being planted to small grain into a 6-year alfalfa planting.	✓	✓	✓
Annually evaluate workforce needs as indicated in the Camas NWR Annual Work Plan, to determine the efficacy of CLMAs in comparison to the Refuge undertaking agricultural plantings through force-account funding.		✓	
Acquire refuge irrigation equipment within 2 years of Well #9 Field cooperative farmer removing personal irrigation equipment		✓	
Should the current cooperative farmer decide to no longer farm the Refuge and remove his irrigation equipment transition from the irrigated CLMA acres identified in objective 3.2c to dry land force-account acres identified in Objective 3.2d.		✓	
Reduce application of water for agricultural irrigation and increase water availability for wetland habitat management by taking the Well #9 field out of production for agriculture irrigation.			✓
Rehabilitate native sage-steppe habitat in the Well #9 field by restoring 20 acres to sage-steppe habitat every 2 years (80 acres rehabilitated by 2020).			✓
Seek and develop partnership opportunities, and associated grant acquisition, to minimize overhead costs of agriculture management and infrastructure.		✓	✓
Annually survey and monitor wildlife use within refuge agriculture crops to assess benefits or impacts from the refuge farming program for wildlife.		✓	✓
Conduct periodic soil tests and work with cooperative farmer to apply proper fertilization and liming treatments, as necessary, to maintain proper nutrient and pH levels for productive agriculture plantings.		✓	✓
Apply lime 6 months before the actual planting date to affect soil pH by planting time.		✓	✓
Attempt to till and plant across the slope, rather than with the slope of the land to reduce erosional forces on soil.		✓	✓
Rotate old alfalfa stands to cereal grains every 6 years or when density of alfalfa reaches 0.75 plants per square foot.		✓	✓
Maintain cereal small grains rotation for 2-years post alfalfa, to lessen autotoxicity and ensure a successful re-establishment of alfalfa in the same field following grain plantings.		✓	✓
Mow grasses adjacent to alfalfa fields to maintain short vegetation along the agriculture field interface to provide additional green forage for and visual security for foraging birds from predators.		✓	✓
Evaluate potential to increase the duration of alfalfa coverage longer than 6 years within established and maintained fields via either increased winter fertilization, increased seeding rates, or decreased spacing between plant rows.		✓	✓
Swath and bale irrigated alfalfa in late summer with the final timing of the harvest occurring at the discretion of the cooperator, based upon the maturity of the alfalfa.	✓	✓	✓

Fall disc and plant alfalfa to re-establish an alfalfa planting just prior to seeding to lessen the amount of soil lost to wind erosion.	✓	✓	✓
Harvest alfalfa through the cooperative agreement based on the amount of funds the cooperative farmer puts into fuel, seed, fertilizer, and irrigation.	✓	✓	✓
Use companion plantings or winter wheat or rye with alfalfa to increase completion and decrease weed establishment.		✓	✓
Apply herbicides on farmed units with refuge personnel through force account refuge funding as-needed to control invasive species.	✓	✓	✓

Rationale, Objective 3.1: Small Grain (Wheat and Barley) and Legume (Alfalfa) Management:

Most waterfowl are opportunistic feeders, and some species such as Canada geese, snow geese, mallard, northern pintails, and teal have learned to capitalize on the abundant foods produced by agriculture (Bellrose 1976). During the last century, migration routes and wintering areas have changed in response to availability of these foods (Fredrickson and Drobney 1979). Some species have developed such strong migratory traditions that many populations are now dependent on agricultural foods for their migration or winter survival (Ringelman 1990). During breeding and molting periods, waterfowl require a balanced diet with high protein content. Agricultural foods, most of which are neither nutritionally balanced nor high in protein, are seldom used during these periods. However, during fall, winter, and early spring, when vegetative foods make up a large part of their diet, agricultural foods are preferred forage except in arctic and subarctic environments (Sugden 1971). Waterfowl management during these periods is often directed at providing small grain and row crops (Baldassarre et al. 1983).

In all alternatives the Refuge would continue to provide supplemental crops for migratory waterfowl and sandhill cranes within the Pacific and Snake River migratory corridor, primarily for the benefit of waterfowl and sandhill cranes. Croplands on refuge and State WMA lands promote sustained use of these areas by migrating waterfowl by providing an accessible, high-energy food source during late fall and early winter as wetlands freeze up. This reduces waterfowl depredation on adjacent croplands. Not only cranes and waterfowl, but many other species benefit directly or indirectly from refuge crops, e.g., long-billed curlews, white-faced ibis, sage-grouse, Swainson’s hawks, and bald eagles.

Formerly, large areas of the Refuge were planted in crops, to support a trumpeter swan recovery project on Red Rock Lakes NWR and later the whooping crane recovery project at Grays Lake NWR. When these programs ended in the mid-1970s Camas NWR scaled back on small grain production. Formerly farmed fields on the Refuge were taken out of production and allowed to revert back to introduced pasture grasses. Although the agricultural footprint on the Refuge has been reduced by approximately 75% since the 1980s, waterfowl population trends in Upper Snake Area appear to have remained relatively constant.

Currently, a total of 160 acres of planted agriculture is provided on the Refuge on two separate 80-acre refuge tracts: the Well #7 Field which has irrigation equipment owned entirely by the Refuge, and the Well #9 Field, which contains a wheel-line irrigation system owned by the cooperator. 20 acres of irrigated small grain is grown in the Well #7 field. The Well #9 Field has not proven to be conducive for growing grain, so all 80 acres are currently in alfalfa. The majority of the farming on the Refuge is done under Cooperative Land Management Agreements (CLMAs) with local farmers, where they provide green forage and grain for migratory birds in exchange for alfalfa cuttings. In all alternatives, the limited overall acreage of small grains, small field size, and the fact that cooperative farmers would have to leave a portion of the crops for wildlife makes growing grain on the Refuge undesirable for cooperative farmers without exchange for alfalfa cuttings.

Habitat management guidelines often encourage managers to produce high-energy foods (Lane and Jensen 1999; Nassar et al. 1993; Nelms 2007; Strader and Stinson 2005); however, true metabolizable energy of many waterfowl foods and selection tendencies of most species are unknown (Dugger et al. 2007; Fredrickson and Taylor 1982). Increasing the refuge acres planted in a larger yield crop such as corn is limited by high cost (due to soil prep, fertilizer and weed control), the need to rotate crops, and the need for increased weed control activities in fallow cornfields (Atkeson and Givens 1952; Foster et al. 2010). As a result the Refuge will continue to cultivate small grains crops all alternatives, since they are less labor and water intensive than a high-energy crop such as corn.

Under the No-Action Alternative (Alternative 1), we would continue to farm 20 acres of irrigated small grain and 140 irrigated acres of alfalfa using CLMAs. All small grain plantings would occur within the Well #7 field with the refuge-owned and supplied irrigation equipment. In the Well #9 field the Refuge would continue to work with a cooperative farmer to maintain 80 acres of alfalfa with the farmer's privately owned irrigation equipment. No rehabilitation of agricultural fields to sage-steppe habitat would occur in Alternative 1.

Alternative 2 (Preferred Alternative) would use CLMAs to farm the Well #7 Field with refuge-owned irrigation equipment to provide 20 acres of irrigated grains and 60 acres of irrigated alfalfa. Small grain plantings would be rotated between the Well #7 and Well #9 fields with no rehabilitation of agricultural fields. Camas NWR owns the irrigation equipment on the Well#7 field and agricultural management is not likely to change within the life of the plan. However, the Refuge does not own the irrigation equipment on the Well #9 field. Should the cooperative farmer decide to no longer farm on the Refuge and remove his irrigation equipment from the Well #9 field, the Refuge would need to acquire irrigation equipment to continue to provide 80 acres of irrigated alfalfa in the Well #9 field. Acquiring a wheel or pivot irrigation system for this field would entail a high initial expense and would substantially increase the Refuge's agricultural management costs. Should the Refuge be unable to irrigate the Well #9 field, the planned contingency in Alternative 2 would be to switch from 80 acres of irrigated alfalfa to 20-40 non-irrigated grains and 20-40 acres non-irrigated alfalfa. This would still provide adequate agricultural forage for local and migratory wildlife, while reducing incurred refuge operation costs. Alternative 3 would use CLMAs to farm the Well #7 field as in Alternative 2, to rotationally produce 20 acres of irrigated small grain and 60 acres of irrigated alfalfa with refuge-owned irrigation equipment. In Alternative 3 the Refuge would no longer farm the Well #9 field and would rehabilitate all 80 acres of the Well #9 field to native sage-steppe habitat.

In Alternatives 2 and 3 the Refuge would implement a consistent strategy to present unharvested or freshly harvested crops in ways that have proven attractive to waterfowl (Reinecke et al. 1989). By mowing strips of small grain crops as they mature in the late summer or early fall the Refuge would ensure a forage base for migrating birds and leave a combination of standing small grain crops and mowed small grain crops (without harvest), to provide wildlife with suitable forage. The proposed approach in Alternatives 2 and 3 for wide swaths of mowed crop separated by several rows of unharvested plants would provide a "snow fence" to enhance the availability of grain on the ground as well as provide a reserve of food that would remain for migratory waterfowl above even the deepest snow. Additionally, by planting crops in blocks of rows running perpendicular to one another the Refuge would ensure that the tops of some rows would be exposed and available to migratory birds by the prevailing winds during heavy snow.

Agricultural management practices. Agricultural practices in Alternatives 1, 2, and 3 would include disking fields (prior to seeding), seeding in fall (spring seeding may be used for perennial crops), tilling, and adding soil amendments/fertilizers. Crop residues are generally removed by fall tilling, but some fields are left fallow over the next summer.

Fall tillage as an agricultural practice eliminates valuable winter food and cover for wildlife and causes soil nutrient loss. By implementing a refuge conservation tillage system that plants with the slope rather than up and down a slope, and avoiding fall tillage for spring plantings, the Refuge would improve soil retention, reduce fertilizer costs, and reduce erosion. Generally, as soil-conserving measures increase, upland wildlife habitat quality also improves (Lines and Perry 1978; Miranowski and Bender 1982). Some soil conservation practices directly benefit habitat quality in that they provide one or more critical habitat elements incidental to their erosion control function. Field border strips are much underused though they increase wildlife food plot yields, while simultaneously providing direct and indirect benefits to wildlife and the environment. As proposed in Alternative 2, planting field border strips around refuge small grain fields would reduce erosion in end rows, reduce non-point source pollutants and sediments, improve water quality, and provide an element of safety for machinery operations (Haufler 2007). Among the benefits of the rotational practices proposed by the Refuge in Alternatives 2 and 3 are higher soil organic matter and nitrogen, lower fossil energy inputs, yields similar to those of conventional systems, and conservation of soil moisture and water resources, which is especially advantageous under drought conditions (Pimentel et al. 2005).

In all alternatives the Refuge will amend soils with lime and appropriate fertilizers. Soil pH can greatly affect the availability of soil nutrients for plant use. Most annual grains will have adequate production for wildlife if the soil pH is near 6 to 6.5 (Westerman 1990). If the soil pH is low, lime can be added to raise it. Tang and colleagues (2003) found that liming at 1.5 ton/acre in 1984 increased grain yield by 25 percent and re-liming in 1999 increased barley yield by over 50 percent. Studies suggest that surface liming can ameliorate subsoil acidity fifteen to seventeen years after application, and that surface liming provides a good strategy to combat subsoil acidity (Dolling and Porter 1994; Tang et al. 2003). Lime should be applied about six months before the actual planting date to affect soil pH by planting time (Tang et al. 2003). Soil tests proposed in Action Alternatives 2 and 3 would allow the Refuge to accurately determine soil pH and lime needs.

Annual grains also respond well to fertilizing (Hansson et al. 1987). Again, refuge soil tests are the only way to accurately determine nutrient deficiencies and needs. Nitrogen (N) and Sulfur (S) are the most yield-limiting nutrient. Phosphorus (P) is the next most limiting nutrient. Levels of potassium (K) and micronutrients generally are sufficient for small grain production in Idaho soils. Nitrogen application almost universally increases cereal yield in all precipitation zones on soils with low available soil N (Schillinger 2006). Nutrient interactions can change this pattern, but only the interaction between N and S is routinely encountered in dryland cereal production. Nitrogen fertilizer application can intensify S deficiency and decrease yield under severe S deficiency (Rasmussen and Douglas 1992).

Incorporating granular N fertilizers during planting or broadcast topdressing granular N fertilizers later in the spring are efficient ways to supply a portion of the total N needs. Most local commercial growers prefer to apply anhydrous ammonia or urea-ammonium-nitrate solution in combination with P fertilizers in a tillage operation prior to planting grain crops. However, in Alternatives 2 and 3 the Refuge would not allow cooperative farmers to apply anhydrous ammonia fertilizers in order to minimize excessive environmental N accumulations. Accumulation of anhydrous ammonia fertilizers can lead to soil and water acidification, contamination of surface and groundwater resources, increased ozone depletion and increased greenhouse gas levels associated with the production of these highly reactive enhanced N fertilizers (Motavalli et al. 2008).

Rationale, Objective 3.1 (Legume Management):
Wildlife in the Upper Snake area and must contend with a radically changed landscape, one where natural wetlands and riparian habitats have been largely replaced by various agricultural crops. Although agricultural foods such as small grains provide an important carbohydrate source during migration, most are neither nutritionally balanced nor high in protein, are seldom used during breeding life-history events

of waterbirds (Ringelman 1990). During breeding and molting periods, waterfowl and waterbirds require a balanced diet with high protein content. In this highly altered landscape, alfalfa provides a surrogate habitat for a wide range of species. Alfalfa supports some of the highest biodiversity amongst row crops, with many species using alfalfa to forage, nest, rest, and hide (Hartman and Kyle 2010). Several bird species such as white-faced ibis, long-billed curlew, and Swainson's hawk are highly dependent on alfalfa to support them given a lack of native wetland and grassland habitat (Hartman and Kyle 2010).

As a legume, alfalfa may be particularly good habitat for earthworms, an important food source for many birds. Alfalfa contributes nitrogen to the soil, and high nitrogen promotes earthworm growth (Evans and Guild 1948) and increases their protein content (Stribling and Doerr 1985). One hypothesis for the preferential use of alfalfa over other irrigated crops by some waterbirds is increased earthworm abundance (Bray and Klebenow 1988). Irrigated fields, and in particular alfalfa, can be valuable feeding sites for white-faced ibis. Ryder and Manry (1994) argue that increased planting of alfalfa is a major reason for an increase in white-faced ibis populations in the West. Bray and Klebenow (1988) propose that where historical white-faced ibis feeding habitats have been diminished, flood irrigated crops could be maintained or even created to benefit ibis, and that the predominant crop should be alfalfa.

Alfalfa often supports an abundant small mammal community that is exploited by various birds of prey. Swainson's hawks will hunt for mice and voles in alfalfa, which provides a long-term, stable habitat for prey and good hunting conditions year round (Estep 1989). The optimal time for Swainson's hawks to use alfalfa is when prey is easily accessible, especially after a cutting or irrigation and when field vegetation is less than 15″ tall (Swolgaard et al. 2008). Swainson's hawks rely heavily on the current agricultural landscape in southeast Idaho to provide adequate hunting grounds and safe nesting sites along riparian corridors. However, frequent early alfalfa cutting changes the amount and structure of vegetation used by many birds for nesting and also destroys nests and eggs of ground-nesting birds (CPIF 2000; Frawley and Best 1991). Because of this the Refuge should limit alfalfa harvests to late summer and not consider or manage alfalfa as a particularly productive nesting habitat.

Alfalfa produces one of the highest crude protein levels and greatest yields of any legume. It is generally considered the most difficult legume to establish, but once established its deep roots makes it very drought-resistant. Alfalfa requires high levels of phosphorus and potassium and soil pH in the 6.6 to 7.2 range. The availability of phosphorus is reduced in low pH soils because it binds with iron and aluminum at pH levels less than 5.5 (Dionne et al. 1989). If the soil pH is too high, phosphorus reacts with calcium reducing the amount available to the plants (Rechcigl et al. 1986). As a result, plants in soils having adequate levels of phosphorus and potassium may not be able to use those nutrients if the pH level is too high or too low (Tsakelidou 2000). Proper soil pH not only increases the availability of essential plant nutrients but promotes the growth of desirable microorganisms and reduces the toxic effects of aluminum and manganese. As with cereal grains, liming can be an effective method of reducing soil acidity in alfalfa fields. Ideally, lime should be applied six to twelve months prior to seeding and thoroughly incorporated into the plow layer. Soil testing proposed in Alternatives 2 and 3 would ensure that lime is added as needed to maintain soil pH at optimal levels, ensuring maximum nutrient availability and reducing need for fertilizers. Should soil testing indicate a need for lime or fertilization, the Refuge and the cooperative farmer would work together to decide on the best strategies to achieve desired soil conditions.

Mowing, plowing and disking a field at the wrong time may cause avoidable weed problems. The general belief is that tillage stirs buried weed seeds up to the surface, allowing them to germinate. The decision to plant legumes in the spring or in the fall may depend on the types of weeds present. If there is an abundance of summer growing weeds (crabgrass, ragweed, foxtail, or lambsquarters) where one intends to plant legumes, one should attempt sowing in the fall. Spring plantings are usually more successful where winter weeds (chickweed, henbit, and yellow rocket) are a problem. Some attention must also be paid to the effects other plants have on the desired legumes. A common refuge grass called quackgrass has been found to be allelopathic, meaning it releases chemicals that may seriously reduce growth or the nitrogen-fixing ability of alfalfa and other legumes. On the positive side, winter wheat or rye plantings are often used as companion crops with legumes because they release chemicals that suppress the development of weeds but do not harm legumes. By mixing legumes with annual wheat or rye as a companion crop in Alternative 2 and 3, the Refuge can provide weed control benefits and in association with fall and winter grain forage while the legume crop matures.

In areas where alfalfa is planted in appropriate soils and managed properly, stands can often last five years with some remaining productive for seven to ten years. The preferred alternative (Alternative 2) would avoid replanting immediately after an old alfalfa stand has declined, as alfalfa produces autotoxic chemicals that can damage new alfalfa seedlings (Jennings and Nelson 2002). This autotoxicity causes poor establishment of alfalfa planted too soon after an old alfalfa stand. Autotoxicity can cause long-term yield reduction of new plants that do become established, although the plants may appear normal. Attempts at thickening declining or thin stands of alfalfa are seldom successful due to autotoxicity from the old plants. Established alfalfa plants can severely reduce establishment and growth of new alfalfa seedlings emerging within an 8-inch radius from the old plant. This means that an old alfalfa stand that is as thin as 0.75 plants per square foot could inhibit establishment of new plants over 100% of the field surface. Research has shown that once alfalfa stands deteriorate, a one-year rotation of another crop other than alfalfa is sufficient for successful re-establishment of alfalfa in the same field (Jennings and Nelson 2002; Wollenhaupt et al. 1995).

The importance of weed control in refuge forage production for wildlife should not be overlooked, especially when the high investment associated with alfalfa and other legume forages is considered. Weeds reduce forage yield by competing for water, sunlight, and nutrients. Vigorous, dense-growing forage legume stands have fewer weed problems. Thus, cultural and management practices that promote a highly competitive forage stand prevent many weed problems. These practices include: 1) liming and fertilizing fields based on soil test recommendations; 2) seeding well-adapted, vigorous, long-lived perennial varieties; 3) buying weed-free seed; 4) cutting forage at proper timing intervals or growth stage; 5) timely control of insect and disease problems; and 6) rotating fields with other crops to interrupt the buildup of certain weeds (Green and Martin 1995). Because of the aggressive nature of some weed species, they can become established despite preventive efforts. Therefore, approved refuge herbicide treatments might be necessary to combat some weed problems.

Objective 3.2 Hay Meadow Management

Annually flood-irrigate, as funds and water are available, *150 acres (45%)* of the total 330 acres of formerly farmed lands which were allowed to revert to non-native grassland, to hay 150 acres of short stature (4"-6") early successional, seasonally flooded wet meadow habitat by August 1 for the benefit of foraging and nesting wildlife.

Benefitting Refuge Species:

Sandhill crane, long-billed curlew, willet, Franklin's gull, white-faced ibis, greater sage-grouse and Canada goose

Hay Meadow short stature habitat is characterized by the following attributes:

- Short (4"-6") meadow grass habitat.
- A diverse array of pasture grasses more palatable and attractive to foraging and nesting wildlife than quack and brome grass meadows.
- Short stature hayed habitat provided by July 15 and no later than August.
- Short stature hayed units to occur within areas where original agricultural fields and irrigation systems were constructed.
- <20% cover of invasive species (e.g., Canada thistle, musk thistle, smooth brome)

Alternatives *Objective as written above is modified by replacing acres in italics with the text in this row.*	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Proportion of formerly farmed areas flood irrigated:	100% 330 acres	✓	0% 0 acres
Strategies Applied to Achieve Objective	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Continue to use Cooperative Land Management Agreements (CLMA) for haying as an alternative to force account farming, fencing and weed control.	✓	✓	
Rotate haying patterns so that no unit would be hayed for 2 consecutive years, allowing at least 60% of old farm fields to have residual cover for the following spring.		✓	✓
Employ late spring or fall prescribed burning in non-native meadows if short-cover habitat objectives cannot be achieved.		✓	✓
Reseed hay meadows predominated quack and brome grasses to a more palatable and desirable mix of grasses and forbs for foraging and nesting wildlife.		✓	
Require cooperators to clean haying equipment before they enter and upon leaving the Refuge, to minimize the amount of weeds being transferred to and from the Refuge.		✓	
Delay first hay cuttings until after July 15th to minimize impacts to nesting or young birds.	✓	✓	✓
Conduct haying operations from July 15-August 1 to provide optimal foraging habitat for fall migratory birds.	✓	✓	✓
Flood irrigate hay units with irrigation capability to ensure good forage can be produced and the quality hay remains acceptable to cooperative farmers.	✓	✓	

Use agricultural practices (e.g., seeding, disking, planting cover crops, fertilizing, soil amendments, herbicides) to rehabilitate pastures that do not meet the habitat objective.	✓	✓	✓
Use IPM strategies including mechanical, physical, biological, and chemical means to eradicate, control, or contain invasive plants.	✓	✓	✓

Rationale, Objective 3.2, Hay Meadow Management:

In all alternatives, a total of 150 acres of early successional short-stature habitats would be created annually by haying. Under Alternative 1 (Current Management), approximately 330 acres of formerly farmed fields would be flood-irrigated annually, and 150 acres of these fields would be hayed annually. Under Alternative 2, only half of this acreage would be flood irrigated, but 150 acres would continue to be hayed annually. Under Alternative 3 we would cease irrigation of formerly farmed fields and hay 150 dryland acres annually.

Haying objectives are designed to increase wildlife foraging opportunity by providing artificially low stature vegetation. Alternatives 1 and 2 support refuge purposes by providing short-cover forage for wildlife within dense non-native grasslands and by contributing to a diversity of habitat types (Eldred 2009; La Sorte and Boecklen 2005). By using cooperative farming in Alternatives 1 and 2, the Refuge would greatly reduce the budgetary and manpower requirements that would be needed if the work were to be performed by refuge staff. Haying would provide feeding areas for migratory birds, primarily waterfowl, a primary purpose for the establishment of this Refuge. Potential wildlife benefits of managed short-cover grassland include: increased palatability of grasses for grazers, increased invertebrate forage availability and detection rates, reduced physical obstruction, and increased security from predators during grazing or foraging activity (Devereux et al. 2006).

The Preferred Alternative (Alternative 2) is to hay 150 acres annually, and rotate haying operations through different parcels, so that the same units would not get hayed two years in a row. Also, by allowing some time for units to recover, forage quality and quantity would increase, while providing denser grass nesting cover for wildlife in un-hayed meadows. Under Alternative 2, Canada geese, greater sandhill cranes, snow geese, curlews, and ducks would benefit from refuge haying operations. These groups of birds regularly use refuge habitats during the fall migration. Refuge hay grounds supplement natural food sources and provide undisturbed/safe areas where migrating birds can forage. Haying would also provide beneficial open foraging areas for elk, deer and other resident species.

Less groundwater would be used under Alternative 2 (Preferred Alternative) than Alternative 1 (only 150 acres would be flood irrigated annually). We would also reseed hay meadows that are predominated by quack and brome grass to a more palatable and desirable mix of grasses for foraging and nesting wildlife. Alternative 2 strikes a balance between water conservation and providing short-cover habitat for the wildlife species that benefit from it. Alternative 3 would eliminate irrigation of hayfields, thereby conserving groundwater resources for higher-priority uses. Forage quality and quantity, and invertebrate populations, would be expected to decline and dryland hayfields would be expected to be less productive and attractive to wildlife than irrigated fields. Forage quantity and quality would also be unlikely to attract cooperative farmers. Therefore dryland haying and other management activities would likely need to be accomplished by permittees or via force account.

Hayed or naturally occurring short-cover habitats are composed of low density grass and forbs 0-4 inches in height with bare ground, or light vegetative litter, with the ground easily visible. Ground foraging birds can easily move through this type of habitat and tend to select short cover habitat over dense grass habitat. Many passerine species prefer short grass pastures as a foraging habitat (Devereux et al. 2004; Perkins et al. 2000; Whitehead et al. 1995). Several mechanisms may underpin this choice, including greater visibility for monitoring predators and conspecifics, improved prey accessibility and better mobility for foragers (Butler and Gillings 2004; Whittingham and Evans 2004; Whittingham and Markland 2002; Wilson et al. 2005). Birds that prefer to forage in short-cover habitat include species in the Meadow Foraging Guild (e.g., greater sandhill crane, long-billed curlew, Canada goose, western meadowlark, American robin, cattle egret; Grazing Waterfowl Guild (e.g., American widgeon, American coot, gadwall, Canada geese); and Upland Nesting Guild (e.g., long-billed curlew, black-necked stilt, killdeer). Many species that forage in short-cover habitat are highly adaptable to human habitat alterations.

There is good evidence that food abundance is the main driver in determining bird usage of fields for both invertebrate-feeders (Brickle et al. 2000), and seed-eaters (Moorcroft et al. 2002; Robinson and Sutherland 1999). However, food availability (i.e., abundance modified by ease of access to that food) has also been shown to be an important factor in determining bird usage (Henderson and Evans 2000; Henderson et al. 2001). Management for short stature, and the abundance and availability of food resources to birds, are inextricably linked (McCracken and Tallowin 2004).

By reducing grass height, haying or mowing affects the amount of, and access to, food resources in different ways. Conventional wisdom in agricultural and range management is that removal of “excess” or “decadent” plant litter increases sunlight and solar radiation, thereby warming soils earlier and promoting plant growth earlier in the spring than areas covered by dense litter (Lecain et al. 2000). Increased access to invertebrates is the principal advantage cited for short-cover management practices (Schekkerman and Beintema 2007). In Northern California, the abundance and diversity of birds, particularly sandhill cranes, on hayed meadow were equal to or greater than the abundance and diversity of birds on nonhayed plots, and cranes spent more time foraging and less time alert in hayed plots (Epperson et al. 1999). However, an unanticipated effect of haying operations is that by reducing detritus, the base of the biotic pyramid, primary and secondary productivity may be reduced (van der Valk 1989). Second, where litter accumulation is scant, invertebrate production may be impeded because of unfavorable conditions associated with hydrology, substrate, and nutrient availability (Magee 1993).

All haying operations involve the use of farm equipment to mow, rake, bale, and transport hay in grassland areas. Several studies show a direct and often substantial impact of the harvesting process on wildlife, especially from the mowing stages, and that this impact depends on the techniques and equipment used, as well as the equipment settings, and the habitat and ecology of each species (Humbert et al. 2009). Paullin et al. (1977) found that young shorebirds were in Oregon were especially vulnerable to mortality from hay cutting in early July. Unlike ducks, shorebirds, especially Wilson’s phalarope, tend to remain in hay meadows to feed after hatching. Consequently, earlier nesting species may be especially vulnerable to mowing. Several other studies suggest that early hay mowing mortality is greatest in the first two weeks of July (Braun et al. 1978; Dale et al. 1997; Labisky 1957; Sargeant and Raveling 1992).

Hay cutting within the Upper Snake Region begins as early as mid-June, likely causing very high rates of shorebird mortality on private property adjacent to the Refuge. Currently, refuge hay operators cannot initiate mowing or harvest of refuge hay until July 15 to ensure that cutting occurs after the nesting season for grassland species is complete. Multiple researchers and management plans support the conclusion that wildlife mortality from seasonal hay mowing can be minimized by not allowing haying before July 15th (Bollinger et al. 1990; Dechant et al. 2003; Krapu et al. 2000; Licht 1997; Perlut et al. 2006; USDA NRCS 2007; Warner and Etter 1989). Managers of some grassland management areas recommend waiting until early August to prevent impacts to double and triple-brooded species such as savannah sparrows and meadowlarks (Warren and Anderson 2005).

GOAL 4: ***Inventory, Monitoring, Adaptive Management, and Research***
Collect, synthesize, and manage science-based information to support the management of Camas NWR and the NWRS at multiple geographic scales.

Objective 4.1: Inventory Habitat and Wildlife

Conduct *prioritized* baseline inventories of vegetation and animal life on Camas NWR, with particular emphasis on suspected or little known groups and species.

Alternatives *Objective as written above is modified by replacing acres in italics with the text in this row.*	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Inventory implementation:	Opportunistic	✓	
Strategies Applied to Achieve Objective	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Compile refuge “Legacy Data” (i.e., existing data sets, annual narratives, reports, theses, museum voucher specimens, and species checklists) that represent historic, not necessarily current, species occurrence, to serve as a benchmark against which future changes can be contrasted.		✓	✓
From 2014-2015, survey, inventory, and assess abiotic resources and physical features (As identified in the Habitat Management Objectives) to develop a Wetland and Riparian Rehabilitation Plan by 2017: 1. Conduct Hydro Geomorphic Model (HGM) and engineering feasibility study by 2015 to determine historic and current physical refuge setting and best future management options. 2. Perform topographic LiDAR survey and construct a Digital Elevation Model (DEM) of the Refuge by 2015 to quantify elevation gradients natural and altered water flows and location, size, and depth of inundation. 3. Perform Water Resource Inventory by 2014 to document refuge water quantity and quality, including physical descriptions of surface water and groundwater features, water rights, infrastructure, and water quality issues. Description of physical characteristics of a station’s water bodies, hydrography, and water-related infrastructure, as attributes relatable to GIS layers, and include both surface and groundwater resources. The inventory would also describe each station’s water rights, water resource needs, and threats. 4. Evaluate and compare historic and current wetland habitat extent with GIS data (e.g., soil maps, USGS maps, LandSAT imagery, LiDAR imagery). 5. Summarize sources of data (e.g., *Idaho Water Supply and Outlook Report*) on winter snowpack and moisture content, spring weather patterns, agricultural acreage, and irrigation techniques, groundwater levels, and other appropriate variables that define annual surface and groundwater availability.		✓	✓

6. Monitor water delivery ditches and groundwater recharge rates to determine how much Camas Creek surface water or pumped groundwater is lost before the water reaches the intended wetland.			
Conduct baseline inventories of refuge biota and vegetation: 1. Survey refuge portions of Camas Creek from 2014-2015 to identify reaches with. a. Relatively intact (few anthropogenic impacts evident) and worthy of maintenance or protection management strategies; b. Reaches where restoration is feasible with changes in current land-use practices or without large expenditures of resources; c. Reaches that could be restored, but only at high cost; and d. Reaches that are in a condition where restoration is not technically feasible due to extreme conditions of alteration, degradation, or sociopolitical issues. 2. Work with the representative agencies that constitute the Upper Snake Sage-grouse Local Working Group to create a useable habitat map and Geographic Information Systems (GIS) database of the Upper Snake area that identifies: leks; nesting and early brood rearing habitat; summer brood rearing habitat, winter habitat; and migration corridors/linkage areas. 3. Within 5 years, using interdisciplinary teams of botanists and zoologists, using standard sampling techniques appropriate for each life form, identify and document little known vegetative and animal life present on the Refuge, their distribution, and relative abundance (e.g., rare, common, abundant). 4. Annually inventory and map established invasive species, with particular attention to the banks of Camas Creek for new source infestation establishment of invasive species and dispersal of seed sources along the creek channel. 5. Use Contaminant Assessment Process (CAP) to assess potential threats posed by environmental contaminants to the Refuge. Inventory point and non-point contaminant sources, identify areas of concern, and describe pathways of contaminant movement that might affect refuge natural resources. 6. Continue butterfly surveys and summarize data from 2005-present. 7. Conduct baseline survey of reptiles and amphibians, stratified by habitat using techniques outlined by Corn and Bury (1990) and Hutchens and De Perno (2009).		✓	✓
Annually analyze, summarize results; disseminate findings to refuge staff, cooperators; and archive all data and reports.		✓	✓
Pursue cooperative funding and partner contributions to implement I&M Objectives		✓	✓

Rationale, Objective 4.1: Inventory Habitat and Wildlife:

The Refuge System is unique among Federal lands in having legislative mandates to maintain and restore biological integrity, biological diversity and environmental health, and to monitor the status and trends of fish, wildlife, and plant resources. Refuges have traditionally focused on the purposes for which each was established, primarily migratory birds, threatened and endangered species, marine mammals, and interjurisdictional fish. The National Wildlife Refuge System Administration Act (NWRSAA) (16 U.S.C. 668dd-668ee), as amended by the 1997 National Wildlife Refuge System Improvement Act (NWRSIA) (Public Law 105-57), requires a more comprehensive approach to managing the natural resources of the Refuge System, and to conducting the inventories and monitoring needed to inform management.

The inherent value of knowing which species occur on a refuge is predicated on the certainty of that knowledge, the rigor with which data were collected, and the spatial distribution of the sampling efforts. These attributes dictate the potential for the Refuge in using inventory data as baseline values for plot-based monitoring, for input into spatial modeling at local scales including the development of vegetation and wildlife species distribution maps, for developing statistical models of species-habitat relationships, for inputs into remote sensing-based models, ground-truthing remotely sensed data, or as validation data sets for spatially explicit models. Refuge inventories proposed in the Preferred Alternative can be a one-time event that simply generates a spatial species list with an unknown level of certainty about its completeness, or it can be the first of a time series in a statistically rigorous, spatially comprehensive monitoring design. The trade-off is that even as the collateral benefits increase with increasing statistical rigor and spatial comprehensiveness, so does the financial cost of conducting the inventory. Camas NWR has attempted to balance the costs with the merits of inventory and monitoring to the Refuge and in a way that data can be integrated by others on public and private lands outside the NWRS.

Detailed and meaningful vegetation/habitat inventory and mapping are fundamental elements to all inventory and monitoring programs, but have not been completed for the vast majority of national wildlife refuges, including Camas NWR. The NWRS Inventory Team specifically recommended the development of vegetation community maps (Byrd et al. 2004) for all refuges. Vegetation mapping of Camas NWR would follow the National Vegetation Classification System. Vegetation inventories would be conducted at a floristic or floristic/physiographic scale. Required sample design and field data collection would be rigorous and intensive to ensure a statistically defensible and accurate inventory. The Refuge would use ancillary data required to develop vegetation inventories, including high resolution multispectral airborne sensors to mid- and coarse-resolution satellite sensors such as LandSat TM and MODIS, depending on the needs of the project.

By inventorying abiotic factors such as soils, hydrology, and geomorphology, the Refuge would provide a foundation for ecological processes and ecosystem restoration to guide refuge management into the future. Biological resources cannot be successfully managed without knowledge of the underlying abiotic resources upon which they ultimately depend and inhabit. Local-scale knowledge of soils, hydrography, topography, and geomorphology would be of primary interest to the Refuge as it collects and synthesizes information to complete a Wetland and Riparian Restoration Plan by 2017.

Hydrogeomorphic analysis (HGM) is a method of assessing ecosystem condition and ecological processes at a site to evaluate departure from historic conditions, identify restoration and management options, and identify ecological attributes needed to restore specific habitats. Completion of the Camas NWR HGM by 2015 would provide the Refuge with a science-based approach to understanding the physical and ecological attributes of landscapes and specific areas within them, such as refuges. HGM uses historic condition and ecological processes (soils hydrology, topography, geomorphology, vegetation), identifies changes to physical condition and ecological process, and generates restoration and management options for a given landscape. An HGM analysis would help the Refuge clarify management objectives and respond to altered hydrologic regimes and climate change by creating a better understanding of the potential for a refuge to support wildlife and plant communities. Restoration options for refuge wetlands and riparian communities would be significantly informed by the HGM.

The Refuge System cannot be expected to adapt strategically to climate change impacts without a better sense of in situ biological diversity. Floral and faunal inventories are critical for benchmarking extant species assemblages before accelerated climate change and non-climate stressors cause extinctions, species redistributions, and novel assemblages. Inventories also set the stage for reasoned and deliberate development of monitoring objectives and a well-designed monitoring program. New data resulting from comprehensive inventories may also redirect current management priorities and assist with assessments of species vulnerability to climate change.

In FY 2008, the NWRS reported spending $15.3 million on invasive species management activities. Rapidly changing climate will only exacerbate the issue. Pests and diseases are likely to move North, and temperature and moisture stresses will weaken native species and make them more susceptible to diseases. Camas NWR needs to remove or mitigate the stress that invasive species put on refuge ecosystems so that fish, wildlife and plants will have the best opportunity to adapt to rapid climate change. Without inventory data, we do not know what the invasive problems are, where invasive species exist, and we do not understand patterns of spread. At a local scale, Camas NWR needs to be able to quantify the extent of the problem through inventory efforts and monitor for early detection of new invaders on refuge lands. By sharing I&M findings with sister agencies and nongovernmental partners through LCCs or other collaborative data-sharing platforms or venues, the Refuge would substantially improve the response for control and eradication of invasive species which threaten refuge resources.

The Refuge System has a legislative mandate, under the NWRSAA, as amended in 1997 by the NWRSIA, to “assist in the maintenance of adequate water quantity and water quality to fulfill the mission of the System and the purposes of each refuge,” and to “acquire, under State law, water rights that are needed for refuge purposes.” The challenge for the Service in light of climate change and growing competition for water is to ensure that sufficient quantities of good quality water are available for fish, wildlife and plants. Camas NWR currently lacks baseline information on refuge water bodies, groundwater supplies, infrastructure, water rights, water quality impairments, threats to water supplies, and needs. By acquiring water resource inventory data, the Refuge would be able to better manage water supplies, prioritize field studies and water rights acquisitions, and develop efficient, informative water monitoring strategies.

The Contaminants Assessment Process (CAP) is a national program that provides a standardized approach for the Service to assess potential threats posed by environmental contaminants without and within the NWRS. By incorporating CAP into refuge I&M strategies, Camas NWR would be able to inventory point and non-point contaminant sources, identify areas of concern, and describe pathways of contaminant movement that might affect a refuge’s natural resources. CAP findings would provide the basis for management actions (such as more detailed investigations, cleanup actions or public outreach, including fish consumption advisories) that refuge managers can take to reduce contaminant impacts on the species and lands under their stewardship. These actions would also enhance health and safety for employees and visitors to the Refuge. Once this site-specific CAP information is acquired, it would support Camas NWR spill response planning, cleanup actions, and natural resource damage assessment, and restoration activities.

Objective 4.2: Adaptively Manage and Monitor Responses to Management			
Support adaptive management at refuge and landscape scales by establishing appropriate metrics (e.g., presence, relative abundance, density, sex and age ratios, reproductive success, annual recruitment, etc.) for *each habitat type and Focal Species* and survey to ensure that these metrics meet or exceed management targets.			
Alternatives *Objective as written above is modified by replacing acres in italics with the text in this row.*	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Communities to monitor:	Waterfowl and waterbirds	✓	
Strategies Applied to Achieve Objective	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Conduct the simplest form of Adaptive Management designed to determine if individual refuges are achieving their specific objective. Tier 1 (Passive Adaptive Management/Low-Intensity Monitoring): 1. Every 3 years assess emergent cover using aerial photography, ground-truthing, and GIS analysis to determine responses to habitat management practices. 2. Monitor large ungulate (i.e., elk, deer, and moose) use of willow communities to ensure habitat structure is not being degraded and natural regeneration and recruitment of willows inhibited. 3. Monitor Camas Creek surface flows daily and file an end-of-the year water usage report with Water District 31. 4. Monitor water usage from all 9 irrigation wells and file end-of-the-year water usage report with The Idaho Department of Water Resources. 5. Monitor public notices of intent on modification of current and new water rights 6. Annually survey and monitor wildlife use within refuge agriculture crops to assess benefits or impacts from the refuge farming program for wildlife. 7. Conduct periodic soil tests and work with cooperative farmer to apply proper fertilization and liming treatments, as necessary, to maintain proper nutrient and pH levels for productive agriculture plantings. 8. Annually monitor vegetation (species composition and condition of plantings) in restored riparian woodland and shelterbelt habitat. 9. Monitor composition and distribution of aquatic vegetation in managed wetlands every 2 to 5 years to determine need for and/or efficacy of treatments, and assess benefits to waterfowl. 10. Establish repeat photo-points to measure effectiveness of invasive species management efforts		✓	✓
Conduct more intensive Adaptive Management of priority CCP objectives which require more rigorous monitoring to provide definitive documentation of management outcomes. Tier 2 (Passive Adaptive Management-Intensive monitoring with implications at the landscape scale): 1. Re-initiate landbird banding and monitoring effort to inventory and monitor spring/fall migrant use and phenology of shelterbelt habitat use.		✓	✓

2. Monitor temporal phenology changes to plants and wildlife that may result from climate change. 3. Annually measure and monitor changes in shallow groundwater depths by measuring depth to groundwater in irrigation wells and using soil augers, digging soil pits or installing groundwater wells in strategic locations, to quantify the depth to saturation of the water table to determine site-potential for wet meadow maintenance, enhancement, and rehabilitation efforts. 4. Monitor agricultural land use practices and associated water rights related to groundwater pumping within the Snake River Aquifer.			
Conduct highly rigorous application of Adaptive Management when there is high uncertainty about the outcomes of management actions, high risks to conservation targets, high costs of management, or public controversy regarding management actions. Tier 3 (Active Adaptive Management-Intensive monitoring): 1. Assess refuge vulnerability to climate change. 2. Establish annual habitat trend plots to measure each specified habitat amount, distribution, condition in managed wetlands: pre-drawdown, post-drawdown and yearly to determine need for drawdown and/or reduction in persistent emergent vegetation. 3. Assess natural and altered landscape disturbance processes to provide accurate recurring monitoring of current and historic disturbance regime attributes (e.g., fire, flooding, drought, wind, erosion, sedimentation) and biotic and abiotic values at risk 4. Annually conduct behavioral act observations (Lehner 1979) of Focal Species in each habitat type within each management unit, in conjunction with other surveys, to ensure that Focal Species are successfully using the habitat for breeding or foraging as predicted. 5. Immediately before and after major habitat management actions (e.g., water level manipulation, prescribed fire, haying), sample terrestrial and/or aquatic invertebrates and/or live trap small mammal communities in each appropriate habitat type in each management unit to document changes in species composition and density (Ross and Murkin 1989).		✓	✓
Use information attained from inventory of abiotic resources and physical features (Objective 4.1) to develop predictive models to adaptively manage refuge water resources and habitats: 1. By 2015, incorporate HGM classification of natural core wetland extent and develop a water budget and predictive model by 2016 to calculate annual potential water availability and optimize the efficient application of water to achieve native wetland habitat objectives. 2. Run predictive models to determine the anticipated annual location and extent of seasonal wetland habitats to be inundated using annual predictive models of water availability for Camas NWR and assigning either “drought”, “normal”, and “wet” annual wetland management prescriptions by 2017, to ensure water levels occur in refuge wetlands		✓	✓

at different heights so no one wetland is maintained at the same water level for prolonged (>3 year) periods. 3. Conduct Hydro Geomorphic Model (HGM) and engineering feasibility study by 2015 (See Goal 4; Objective 4.1) to determine historic and current physical refuge setting and best future management options. 4. Adaptively adjust and recalculate predictive water models based on annual model performance. 5. By 2017, formulate and use plant community-specific tolerance thresholds, as determined through a Camas NWR State-and-Transition Model, to influence management prescriptions to meet annual and long-term wet meadow habitat objectives. 6. Evaluate the anticipated responses and model the trajectory of sagebrush communities to human-associated disturbances across the Upper Snake regional ecosystem as the basis for spatial prioritization of landscape scale management.			
Document all responses that fall short of management goals, ascertain causes, and employ adaptive management to correct management prescriptions.		✓	✓
Annually analyze, summarize results; disseminate findings to refuge staff, cooperators; and archive all data and reports.		✓	✓
Pursue cooperative funding and partner contributions to implement I&M objectives.		✓	✓

Rationale, Objective 4.2: Adaptively Manage and Monitor Responses to Management:

The Refuge would use an adaptive management (AM) decision making process to implement management strategies authorized in the Comprehensive Conservation Plan (CCP). Adaptive management is a science-based public participation process for evaluating and adjusting a conservation effort relative to goal achievement as experience and knowledge are gained through implementation, study and discussion. The Refuge and its collaborative partners support the fact that AM promotes flexible decision making which can be adjusted in the face of uncertainties, as outcomes from management actions and other events become better understood. As the CCP is implemented, AM would help the Refuge achieve diverse goals while enhancing wildlife benefits, advancing scientific knowledge, and improving working relationships among stakeholders.

The principle of AM is based on the recognition that ecosystem function is inherently complex and often results in knowledge gaps. AM implementation means a firm commitment to the development of measurable outcomes and the application of rigorous evaluation and monitoring methods to determine whether management goals are being met. Careful monitoring of these actions advances scientific understanding and helps adjust policies or operations as part of an on-going learning process. This is not a "trial and error" process but rather emphasizes "learning while doing," which recognizes the importance of incorporating new information as it becomes available. AM requires flexibility and an ability to acknowledge risks/failures while using new knowledge in a constructive manner to make adjustments while building a foundation for ongoing learning/adjustment.

The Refuge is committed to a rigorous and inclusive AM approach to enhance public confidence in the ability of the Refuge to transfer theory to practice. The Refuge recognizes as it moves forward with CCP implementation that there is a critical need for transparency. This transparency, as it pertains to AM, needs to include both the learning and decision making processes. The following discussion describes how the Refuge would move forward through AM.

The AM process would bring diverse interests together through various forums to share information and site-specific results so that all those engaged, including the Refuge, can learn together. These forums would evolve through time but would include mechanisms such as the Aquatic Health Coalition, the Ecology Working Group and an evolution of the Collaborative Planning Group. The timing and frequency of information sharing/learning would be determined by how rapidly new information is being acquired, level of partners' interest/engagement, ecological cycles and the forum being used. The Refuge would share the results of its inventory and monitoring work. Additionally, the Refuge would be responsive to partners' requests for open discussion and collaboration in assessing the need for adaptive changes in management.

As the Refuge and partners learn through the AM process, new information may show the need for adjustments, confirm existing strategies or identify additional information needs. Based on the best information available at the time, the Refuge would make decisions for future management actions. As with the sharing/learning aspects of AM, the Refuge recognizes the importance of transparency for decisions made during the AM process. The Refuge is committed to bringing together interested parties to assist with, the evaluation of available information and consultation about management options and their implications prior to making course changing decisions. This process does not diminish the Refuge's legal authority to make decisions, but rather serves to enhance the decision making process by enabling the Refuge to approach issues from multiple perspectives, thereby finding creative solutions to complex challenges.

Objective 4.3: Survey Wildlife and Habitat Trends			
Conduct *prioritized* surveys of wildlife and habitats for *focal or rare species or species groups*, to determine which, if any, habitat or population management strategies should be undertaken for their benefit.			
Alternatives *Objective as written above is modified by replacing acres in italics with the text in this row.*	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Inventory implementation:	Opportunistic	✓	✓
Inventory emphasis:	Waterfowl and waterbirds	✓	✓
Strategies Applied to Achieve Objective	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Conduct status and trend surveys of priority fish and wildlife species: 1. Annually conduct standard avian point counts (Ralph and Scott 1981) stratified by habitat type to measure breeding migrant landbird density by habitat type on the Refuge. 2. Annually conduct nest searches for breeding avian focal species using plots or transects to measure nest density and success. 3. Annually conduct secretive marsh bird surveys (Conway 2005) to document presence and relative abundance of Focal Species.		✓	✓

4. Annually conduct ground surveys of Focal shorebird species from April through October to document the presence and relative abundance. 5. Annually survey for reptiles and amphibians stratified by habitat using techniques outlined by Corn and Bury (1990) and Hutchens and De Perno (2009). 6. Annually assist in conducting the Southeast Idaho NWRC bi-monthly low level aerial fall survey to document the fall RMP sandhill crane population. 7. Annually assist in conducting the Southeast Idaho NWRC low level aerial surveys April through September to assess the Tri-state Trumpeter swan population (breeding and production) 8. Survey focal waterfowl and waterbird species (breeding/migration) 9. Survey fall refuge sandhill crane population (migration) 10.Work with IDFG to fund and perform census of refuge and local elk population 11.Weekly survey wintering refuge eagle roosts 12.Assist IDFG in regional mid-winter eagle survey 13.Annually monitor 6 to 10 (as to rotate through all the monitoring plots every 8 to 10 years) of the 60 established long-term vegetative trend sites 14. Participate in the pollinator monitoring initiative hosted by the USGS at Patuxent Wildlife Research Center in Maryland			

Rationale, Objective 4.3: Survey Wildlife and Habitat Trends:

Research, scientific collecting, and surveys on refuge lands are inherently valuable to the Service because they expand scientific information available for resource management decisions. Use of the Refuge to conduct research, scientific collecting, and surveys would generally provide information that would 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 (for example, CCPs, HMPs, and Fire Management Plans). 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.

In 2007 the Refuge decided to suspend an ongoing mist netting portion of a refuge inventory and monitoring study, due to a variety of concerns including funding availability, USFWS's lack of personnel, and opposition to the mist netting from a contingent of the Idaho birding community. Assuming continued habitat restoration occurs at Camas NWR in Alternative 2, and/or there is sufficient interest, the Refuge would resume mist netting with the idea of measuring potential response to restoration efforts and/or future migrant abundance, richness, migration timing, and energetic condition on five-year intervals (two to three years on, five years off), creating a seven- to eight-year on/off cycle. As regards the "on" part of the cycle, two years is viewed as an absolute minimum, whereas three consecutive years (pending funding and logistical support), would better allow us to account for annual fluctuations in analyses.

Objective 4.4: Applied Research			
Through the life of the CCP, develop a program capable of recruiting qualified researchers and funding to conduct high-priority research projects, which provide *rigorous* scientific-based information to positively affect future management decisions and test uncertain assumptions.			
Alternatives *Objective as written above is modified by replacing acres in italics with the text in this row.*	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Quality of data	Credible	✓	✓
Strategies Applied to Achieve Objective	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Continuously work with refuge and SEINWRC staff, other Federal agencies, State agencies, universities, and non-governmental organizations to identify and prioritize appropriate research questions most germane to refuge management and Service mandates.		✓	✓
Construct and continually maintain a spreadsheet of all potential research projects, their refuge and regional priority rank, potential partners, and approximate costs.		✓	✓
Ensure all research projects involving the Refuge and refuge staff adhere to the highest standards of science.		✓	✓
At appropriate intervals (annual progress reports, project completion and technical publications) share all information with all refuge and SEINWRC staff, project partners, and local media.		✓	✓
Pursue cooperative funding and partner contributions to implement identified research projects.		✓	✓
As appropriate, integrate all research findings into refuge habitat and population management actions.		✓	✓

Rationale, Objective 4.4: Applied Research:

Although knowledge of highly complex ecological systems will always be incomplete, agencies must make management decisions using the best information to guide their actions. By systematically identifying uncertainties at Camas NWR, the Refuge can highlight a biological foundation for acquiring information through applied research. In the absence of perfect knowledge, it is necessary to make assumptions which are essentially testable hypotheses about uncertainties. However, not all assumptions are equally important. By considering each assumption in light of two factors (how uncertain it is; and to what extent better information would affect future management decisions), refuge assumptions that are both tenuous and high impact can be identified. There would therefore be the priorities for Camas NWR research.

Goal 5: <u>Wildlife-dependent Recreation and Public Use</u>

Increase public understanding and appreciation of wildlife, and build support for Camas NWR by providing opportunities for all visitors to participate in safe, quality wildlife-dependent recreation and education programs, while minimizing wildlife disturbance or other impacts to wildlife populations or habitats.

Objective 5.1: Welcome and Orient Visitors			
By 2017, enhance the Refuge's ability to conduct outreach and welcome and orient visitors of all ages and abilities, through improved facilities, increased staffing, and more effective use of print and electronic media.			
Strategies Applied to Achieve Objective	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Provide self-service visitor orientation facilities (kiosk) and comfort station at refuge headquarters.	✓	✓	✓
Provide small visitor contact area at refuge office. Refuge staff would greet and orient visitors that come into the office, on weekdays during normal business hours.	✓		
Construct a combined refuge office, small visitor contact station and environmental education multi-purpose room at the headquarters site. The visitor contact station would be staffed by volunteers and/or Friends group members 7 days per week during high visitation periods and during special events.		✓	✓
Create an on-site staff position (Park Ranger and/or Visitor Services Manager) to develop and deliver outreach and visitor services programs, manager volunteer program and develop partnerships (also see Objectives 5.3, 5.5 below).		✓	✓
Develop Outreach and Communications Plan for Refuge, including key messages and audiences and communication strategies.		✓	✓
Participate in at least one community event annually (e.g., Dubois Grouse Days).	✓	✓	✓
Revise the Refuge's general brochure with updated regulations, text, maps and photographs.		✓	✓
Update panels on informational kiosk in visitor parking area to include migratory bird information and updated refuge map.		✓	✓
Revise the refuge website with improved photos, navigation aids and maps. Provide interactive Web capability for visitors to electronically post wildlife observations/photos. Post PDF files for all publications on refuge website.		✓	✓
Host at least one public event per year (e.g., Migratory Bird Day).	✓	✓	✓

Rationale, Objective 5.1: Welcome and Orient Visitors:

Camas NWR has a very small staff with only three permanent employees, and therefore currently relies mainly on unstaffed, self-serve facilities to welcome and orient the public. Self-serve facilities and associated print products would be improved and/or enhanced to make them as user-friendly as possible.

Updated maps would more clearly show where and when the public can participate in recreational activities. Updated panels in the main parking lot kiosk would emphasize the purpose of the Refuge: a home and breeding ground for migratory birds. (The current panels emphasize big game species rather than migratory birds.) Refuge information available through print and electronic media (Web) would also be updated and upgraded, including interactive interfaces that provide opportunities for the public to post their wildlife observations on the refuge website. This would allow the Refuge to reach and interact with a larger and more diverse audience.

While “self-serve” facilities would continue to be important, direct personal contact with visitors is a more effective way to welcome and orient visitors, educate them about the Refuge and its wildlife, and enlist their support for our mission. The current office is the former manager’s residence and includes a small visitor contact area, but is not designed as a visitor contact station. It is not staffed on weekends, nor is it consistently staffed on weekdays. Most visitors bypass the office and continue directly to the auto tour route or trails. It would be desirable to have an office/visitor contact station on-site that is consistently staffed during peak visitation periods, including weekends. Using volunteers or Friends Group members to staff the visitor contact station would allow the public better access to information and provide opportunities to interact with people who have knowledge of the Refuge, especially during high traffic or special events. Having better, and more consistently staffed facilities to welcome and orient visitors would not only enhance visitors’ experiences and increase their understanding of refuge wildlife, habitats, and resource management issues, but may also increase visitation through word of mouth in surrounding communities. An increased staff presence may also increase compliance with refuge regulations. Because the Refuge would rely heavily on volunteers to staff the visitor contact station, hiring a position dedicated to visitor services would be necessary to recruit, manage and train volunteers (see Objective 4.5 below).

Outreach. Outreach is crucial to distinguishing the Service’s National Wildlife Refuge System from other lands managed by other natural resource agencies. When the public knows and understands the role of the Service, the Refuge System, and Camas NWR, it results in several benefits. By increasing public understanding and appreciation of the Refuge’s wildlife and habitat resources, the Refuge expects increased public support for protecting and enhancing refuge lands, thereby achieving the overall goal of protection and stewardship of wildlife. A greater understanding of refuge regulations and policies, and the reasons behind them, reduces violations necessitating LE. Outreach programs must be carefully designed in order to be successful. Design of outreach programs begins with identification of key messages and target audiences, and culminates in the development and delivery of specific tools or programs.

Small staff size not only limits refuge interaction with the public, but also limits opportunities to conduct outreach. Currently the Refuge relies primarily on its website and brochures as outreach tools. However, there are opportunities to improve refuge outreach, through both print and electronic media and direct interaction with the public. Hiring one position dedicated to visitor services would allow the Refuge to conduct outreach, improve visitor services programs and leverage partnership and volunteer opportunities in order to develop new programs (e.g., interpretation, environmental education, and guided tours).

Objective 5.2: Wildlife Observation and Photography

Provide opportunities for *<u>self-guided and guided</u>* wildlife observation and photography at by annually maintaining a 6.3 mile year-long auto tour loop; *<u>6.5 additional miles</u>* of roads open seasonally to vehicles and pedestrian traffic; a *<u>1.3 mile</u>* birding trail; and approximately *<u>27 miles</u>* of service roads open year round to hiking, biking, snowshoeing, or cross-country skiing as conditions permit.

Alternatives *Objective as written above is modified by replacing acres in italics with the text in this row.*	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Type of Opportunity	Self-guided only	✓	
Birding trail	0.5 miles	✓	
Service roads open to hiking, bicycling, cross-country skiing, and snowshoeing as conditions permit	✓		
Additional roads open seasonally to vehicles and pedestrian traffic for wildlife observation, photography, and hunt area access	✓ (open during hunting seasons only)		14 miles (6.5 miles during hunt seasons; 7.5 miles July 1-Nov 1)
Strategies Applied to Achieve Objective	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Provide a 6.3-mile, two-way, self-guided auto-tour route, with 9 pullouts and interpretive panels, that is open year round to vehicle, foot, and bicycle traffic.	✓		
As above, but change route to one-way to provide for public safety.		✓	✓
Provide an additional 6.5 miles of roads that are open to vehicle and pedestrian traffic during the hunting season for wildlife observation and photography and provide access to hunting areas (roads are leading to and within the north and south waterfowl and upland game hunting units).	✓	✓	✓
Re-open the 7.5 mile Sandhole Lake loop road to vehicle traffic from July 1 to November 1 annually.			✓
Allow hiking, bicycling, cross-country skiing, and snowshoeing on 27 miles of unmaintained/ungroomed service roads, as conditions permit.	✓	✓	
Maintain some groomed winter trail through refuge partnerships with local public user groups interested in winter refuge activities.		✓	
Allow hiking, bicycling, cross-country skiing, and snowshoeing on 27 miles of service roads year round as conditions permit. Groom 10 miles of service roads for cross-country skiing, and snowshoeing; 17 miles ungroomed/unmaintained.			✓
Off-road hiking permitted throughout the Refuge, July 15- Feb. 28.	✓		
Off-road hiking not permitted, except by hunters in possession of valid State licenses during hunting seasons.		✓	

Off-road hiking not permitted, except by hunters in possession of valid State licenses during hunting seasons, except as follows: Off-road hiking permitted year round in the north waterfowl and upland game hunting unit (980 acres); Jan 1-July 31 in the south waterfowl and upland game hunting unit (1,530 acres).			✓
Dog walking allowed in all areas that are open to public use. Dogs must be on leash or under close control.	✓		
Dog walking allowed only on roads that are open to public use. Dogs are required to be on a leash or wear a functional electronic collar at all times.		✓	✓
Develop print and/or digital interpretive media for self-guided tours of the Refuge's Auto Tour Route, service roads and trails.		✓	✓
Maintain a ½ mile long birding/walking tail that starts at visitor center parking lot.	✓		
Complete a 1.3 mile birding/walking trail that starts at the visitor parking lot.		✓	✓
Maintain wildlife observation platform on Camas Creek, near refuge headquarters.	✓	✓	✓
Allow the use of personal portable photo blinds on Refuge within 100 feet of refuge roads. Allow no more than 5 portable blinds on the Refuge at any given time. Photographers must reserve space in advance.		✓	✓
Construct three semipermanent photo blinds, using input from local photographers. Blinds would be available by reservation only.			✓
Conduct at least 8 guided wildlife-based refuge tours annually during the peak of wildlife viewing times (e.g., snow goose migration, wintering bald eagles and/or fall elk tours). Tours would be advertised on the refuge website, Friends Group website and newsletter, and Audubon and local tourism bureau websites. Guided tours would be limited to 30 visitors and slots would be filled on a first-come, first-serve basis.		✓	
Conduct at least 12 guided wildlife-based refuge tours annually during the peak of wildlife viewing times (e.g., snow goose migration, wintering bald eagles and/or fall elk tours). Tours would be advertised on the refuge website, Friends Group website and newsletter, and Audubon and local tourism bureau websites. Guided tours would be limited to 30 visitors and slots would be filled on a first-come, first-serve basis.			✓
Provide visitor sign-in/comment station at trail heads to photography/hunting blinds. Develop means for visitors to "sign in" and record wildlife observations electronically (directly to website or social media).		✓	✓

Rationale, Objective 5.2: Wildlife Observation and Photography:

In accordance with the National Wildlife Refuge System Administration Act of 1996, as amended, refuges are encouraged to provide wildlife observation and photography opportunities wherever they are compatible with refuge purposes. Allowing automobile traffic on a small portion of the road system at

Camas NWR (the Auto Tour Route and hunter access roads) limits disturbance to wildlife, yet still allows vehicle access to a diverse and scenic drive of the Refuge. Keeping the auto tour route open during the winter allows visitors to see bald eagles that roost on the Refuge, white-tailed deer, and other wildlife, as well as spectacular winter sunrises and sunsets. With almost 40 miles of roads on the Refuge, many different types of outdoor activities, including hiking, snowshoeing, cross-country skiing, and bicycling, can be accommodated while minimizing disturbance to wildlife and impact to habitat.

The Auto Tour Route (ATR) is currently open to vehicle traffic (vehicles licensed for highway use only), bicycling, walking, dog walking (under control of owner), cross-country skiing, and snow shoeing. Few visitors have been observed walking or bicycling on the ATR. Given these low numbers, conflicts between vehicles, pedestrians, bicyclists, or any other visitor uses are negligible to nonexistent. Based upon data gathered from a vehicle traffic counter installed on the ATR in 2009, from 50 to 370 vehicles used the ATR per month, with the peak occurring from March to June. To date no accidents or incidents on the auto tour route have been reported or observed by refuge staff. The auto tour route is currently maintained in winter to the best of our abilities to keep the road open. Changing the auto tour route from two-way to one-way traffic, as proposed in Alternatives 2 and 3, would eliminate many of the issues with cars trying to pass on the narrow roads with steep ditches. Construction of the birding trail near refuge headquarters was initiated about five years ago. Currently the birding tail is only about one half mile long and does not have a defined or complete loop. Under Alternatives 2 and 3, a 1.3 mile loop would be completed that takes visitors through the best landbird habitat the Camas NWR has to offer.

Anticipated direct impacts of wildlife observation and photography include disturbance to wildlife by human presence which typically results in a temporary displacement of individuals or groups. Immediate responses by wildlife to recreational activity can range from behavioral changes including nest abandonment or change in food habits, physiological changes such as elevated heart rates due to flight, or even death (Knight and Cole 1995). The long-term effects are more difficult to assess but may include altered behavior, vigor, productivity, or death of individuals; altered population abundance, distribution, or demographics; and altered community species composition and interactions. Knight and Cole (1991) found that wildlife responses to human disturbance include avoidance, habituation, and attraction.

In this CCP the Refuge must consider the location and timing of recreational activities and how observational recreation can impact species in different ways. The Preferred Alternative prohibits off-road hiking and limits wildlife observation and photography to designated roads and trails. This approach is more restrictive than either Current Management or Alternative 3, but affords the most positive benefit to refuge wildlife by minimizing wildlife disturbance through restrictive off-road hiking access. Stolen (2003) found that the proximity of wading birds to a roadway influenced the probability that a given bird would flush. Migratory waterfowl at J.N. “Ding” Darling NWR remained more than 80 m (262 feet) from the auto tour route, even when human visitation was low (Klein 1995). Miller et al. (1998) found that nesting success was lower near recreational trails, where human activity was common, than at greater distances from the trails.

The Refuge is popular with wildlife photographers, and has received requests to construct a permanent photo blind. One of the issues with establishing a permanent structure is that water management and wildlife use vary by year and therefore, an established blind would not always be in a desirable location. Since a permanent blind may not get enough use to justify its construction, better options would be: (1) Allow, on a reservation basis, the use of portable blinds for photography in designated areas (the user would have to remove the blind while not in use); or (2) Place semipermanent portable blinds. Such blinds have been used successfully at other refuges. Either option would allow photographers to take advantage of seasonal changes in lighting, habitat, and wildlife use patterns. Photographers would be allowed to place their own blinds within 100 feet of roads in Alternatives 2 and 3. The number of portable blinds would be limited to 5 at any given time, on a reservation basis, to reduce user conflicts and provide a quality experience. Semipermanent blinds are proposed in Alternative 3.

While self-guided programs would continue to constitute the majority of refuge use, opportunities to observe and learn about wildlife can be greatly enhanced though guided programs. While more staff-intensive, these programs increase visitor success in seeing wildlife, provide access to areas that are otherwise closed to the public, provide greater opportunities to convey key messages (e.g., wildlife and habitat conservation, viewing techniques/ethics), and have the potential for high return for effort (e.g., volunteer recruitment). For example, at Bear River Migratory Bird Refuge, their guided tour program is their most popular program, and slots are always filled to capacity. Guided tours provide opportunities to serve a targeted audience while minimizing undesirable impacts to wildlife. At Camas NWR there are several key periods when birds or other wildlife are reliably present and active enough to warrant regular guided tours, for example the snow goose migration, the fall rut (elk, white tailed deer), and bald eagle roosting in winter. However additional staffing and volunteers would be required to develop this program, as well as interpretive and educational programs (see Objectives 5.1, 5.4).

<table>
<tr><th colspan="4">Objective 5.3: Environmental Education and Interpretation</th></tr>
<tr><td colspan="4">(5.3a) Annually provide educational programs and guided refuge tours that reach at least <u>1,000 to 1,100 students</u>, members of youth groups and other members of the public, within 10 years of program implementation.

(5.3b) Provide <u>10-15</u> guided wildlife based refuge tours to <u>200-300 participants</u> annually, conducted by <u>refuge staff and/or trained volunteers</u>, to youth and special interest groups that expand their awareness of the Refuge’s habitat and wildlife.</td></tr>
<tr><td>Alternatives
Objective as written above is modified by replacing acres in italics with the text in this row.</td><td>Alt 1 Current</td><td>Alt 2 Preferred</td><td>Alt 3</td></tr>
<tr><td>(5.3a) Total number of participants annually (students; youth and special interest groups)</td><td>400-450</td><td>✓</td><td>2,400</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td>(5.3b) Number of refuge tours:</td><td>6-10 tours</td><td>✓</td><td>20 tours</td></tr>
<tr><td>(5.3b) Tours conducted by:</td><td>By refuge staff</td><td colspan="2">✓</td></tr>
<tr><td>(5.3b) Participants annually:</td><td>150-200</td><td>✓</td><td>400</td></tr>
<tr><td>Strategies Applied to Achieve Objective</td><td>Alt 1 Current</td><td>Alt 2 Preferred</td><td>Alt 3</td></tr>
<tr><td>Target educational and interpretive programs to increase public awareness of wetland and upland species diversity and ecology, Camas NWR habitat management actions, energy and water conservation actions and the mission of the National Wildlife Refuge System.</td><td></td><td>✓</td><td>✓</td></tr>
<tr><td>Staff a full time position at Camas Refuge (Park Ranger) to develop and coordinate environmental education programs, including: developing refuge-specific curricula that meet State standards; delivering teacher training; and overseeing EE program.</td><td></td><td>✓</td><td>✓</td></tr>
</table>

Staff a full time volunteer coordinator position in the Southeast Idaho Complex Office to oversee recruitment and training of volunteers and develop education programs on all four refuges within the Southeast Idaho Complex.		✓	✓
Provide volunteer-led environmental education programs to approximately 250 students annually.	✓		
Construct a combined refuge office, small visitor station, and environmental education multi-purpose classrooms to provide outdoor public learning opportunities for local schools and universities.		✓	✓
Provide environmental education programs to 300 students for the first 5 years after construction of the new environmental multi-purpose classroom and then 800 students in the second 5 years of implementation.		✓	
Provide environmental education programs to 2,000 students for the ten years after construction of the new environmental multi-purpose classroom			✓
Grade K-12 EE programs on the Refuge would be conducted by teachers who have received training in the use of refuge-specific curricula, or Service-wide curricula such as Project Wild or Project Wet. Encourage the use of the Refuge as an “outdoor classroom” for programs such as Project Wild or Project Wet.		✓	✓
Conduct at least one teacher workshop annually to ensure that key Refuge System messages are delivered appropriate to grade level.		✓	✓
Encourage the use of the Refuge as an “outdoor classroom” for local universities to hold field classes or other resource related education (e.g., water rights, hydrology, geology and soils, wildlife biology and management, range sciences, botany).		✓	✓
Develop refuge programs to encourage Scouting participation. Develop and conduct programs that would allow Scouting groups to earn badges while learning in an outdoor setting.		✓	✓
Work cooperatively with BYU-Idaho to involve student participation in inventory and monitoring programs being established on the Refuge.		✓	✓
Develop a quality interpretation program that fosters long-term interest in the conservation of natural resources among visitors or all ages, and fosters a connection between children and nature. Staff would be responsible for developing program content and delivering training to volunteers, who would conduct the program.		✓	✓

Rationale, Objective 5.3: Environmental Education and Interpretation:

Environmental education and interpretation play a key role in encouraging current and future generations to engage in environmentally responsible behavior, including supporting the protection of habitat for wildlife through the National Wildlife Refuge System. The Refuge is close enough to the Idaho Falls school district to be able to serve large numbers of students. The surrounding communities also have strong Scouting programs, and local Scout groups are always looking for educational opportunities in outdoor settings.

Currently, with no visitor services staff for the Refuge or the Refuge Complex, and a small number of volunteers, EE and interpretation programs on the Refuge are limited. The refuge manager provides tours to Scout groups on request, serving approximately 150-200 Scouts annually. Volunteers reach an additional 250 students annually. There are no teacher training programs or refuge-specific curricula. Reaching more students and offering high quality EE and interpretive programs would require a full-time Park Ranger or Visitor Services Manager who would also recruit, train, and oversee volunteer staff to implement the program. Hiring a position dedicated to visitor services would allow the Refuge to improve visitor services programs, and leverage partnership and volunteer opportunities in order to develop new programs (e.g., interpretation, environmental education, and guided tours). Strategically placed interpretive media, including interpretive panels, brochures, and posters, are currently used by the Refuge and would continue to be developed and used as educational tools. Web-based media would also be used to reach an increasingly diverse and tech-savvy audience.

With its close proximity to the Idaho Falls school system, BYU-Idaho and the Idaho National Laboratory (INL), opportunities exist to recruit and train a cadre of volunteers to engage students in a wide variety of science-based educational programs. With the proper facilities and staff support in place, Camas NWR would provide an excellent setting to host teacher training workshops such as Project Wild or Project Wet. Project Wild workshops have been hosted at Camas NWR in the past. If reinstated, these workshops would be likely to be popular with local teachers, since they provide an opportunity to earn credits. In addition, teachers that are trained on the Refuge are likely to bring their students back.

The Refuge also has the opportunity to partner with the BYU-Idaho and INL to participate in inventory and monitoring programs. BYU-Idaho has a growing enrollment of students in the biological sciences that are willing and eager to work on projects related to wildlife biology and management. Faculty at BYU-I have expressed interest in establishing a relationship with the Refuge and other natural resource organizations that would allow students to help with projects while gaining valuable field experience that would make them more competitive in the job market. Having adequate staff and a viable facility to host educational programs would help foster a continuous partnership that would lead to collection of high quality data that would help the Refuge attain its inventory, monitoring, and research goals.

Objective 5.4: Hunting

(5.4a): Annually provide a quality, safe migratory game bird hunt (for ducks, geese, mergansers, American coots, and Wilson’s snipe) on 2,510 acres of Camas Refuge.

(5.4b): Annually provide a quality, safe upland game bird hunt (for snipe, gray partridge, pheasants, and sage-grouse) on 2,510 acres of Camas NWR.

(5.4c): Annually provide a quality, safe hunt for elk on approximately *4,112 acres* of the Refuge.

Alternatives *Objective as written above is modified by replacing acres in italics with the text in this row.*	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
(5.4c) Acres open to elk hunting	0	4,112	

Strategies Applied to Achieve Objective	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Hunting would occur in accordance with Idaho, Federal, and any special refuge regulations.	✓	✓	✓

The Refuge is open to sportsmen and visitors from one half hour before sunrise and one half hour after sunset.	✓	✓	✓
Approved non-toxic shot is required for hunting all bird species.	✓	✓	✓
In 2018, after the changes in water management described in the CCP are initiated, re-evaluate the size and location of the waterfowl hunt area. Depending upon wetland response to changes in water management, consider shifting the waterfowl hunt units into areas with more reliable fall water, or enlarging the waterfowl hunt area. Areas open to migratory bird hunting would not exceed 40% of the total refuge acres.		✓	✓
Allow an elk hunt on 4,112 acres of the Refuge. Elk hunting would be allowed on Fridays, Saturdays, Sundays, Mondays, and Tuesdays during the Idaho season for Unit 63, as specified in Idaho Fish and Game Big Game Hunting Rules: Any elk (bull and antlerless) may be harvested between August 1 and August 31. Antlerless elk may be harvested from September 1 through December 31.		✓	✓
Issue up to 20 elk hunting access permits annually to hunters holding valid State elk tags for GMU 63, by random draw. The number of permits issued would be determined by the staff of Camas NWR in coordination with the IDFG before the beginning of each season. Refuge access permit would allow hunters to access the Refuge on hunt days for two weeks, until an elk was harvested. Priority would be given to youth and mobility impaired hunters. If the number of youth and mobility impaired hunter applicants is less than the total number of access permits being issued in a given season, other applications would be included in the drawing for access permits.		✓	✓
The refuge manager would meet annually (May) with regional IDFG staff to discuss elk population levels in the general area and decide on the number of access permits that would be allowed for the Refuge based upon the effectiveness of the previous season’s elk hunt.		✓	✓
A maximum of two elk hunters would be allowed on the Refuge at any given time. (Youth hunters age 12-17 must be accompanied by an adult; mobility impaired hunters may be accompanied by a non hunting assistant designated in writing in accordance with State regulations.)		✓	✓
All elk hunters would receive a pre-hunt orientation from USFWS Southeast Idaho Complex employees (including LE Officers), or volunteers trained by Camas NWR or SE Idaho Complex staff.		✓	✓
Mobility-impaired hunters may use temporary hunting blinds. They would be taken to and from hunting blinds by refuge personnel or a trained volunteer using a refuge-owned utility terrain vehicle (UTV). Hunting from vehicles is prohibited.		✓	✓
Weapons used in elk hunting would be shoulder fired, center fire with cartridges larger than 20 caliber.		✓	✓
Successful hunters (or non hunting assistants of mobility impaired hunters) would be allowed to move a harvested elk to the nearest established, designated refuge road by foot. Vehicles would then be used to remove the elk from the Refuge. Refuge personnel or a designated trained volunteer would aid in the removal of elk harvested by mobility impaired hunters.		✓	✓

Hunters must maintain a distance of at least 400 m (¼ mile) of roosting sandhill cranes. Elk hunters would be advised of the presence of sensitive non-target wildlife species, and setback distances and/or area closures, in the pre-hunt orientation.		✓	✓
Refuge personnel would meet in January to evaluate the safety and quality aspects of the elk hunt and make adjustments to number of hunters and area closures if necessary to ensure a safe, quality hunt that minimizes impacts to sensitive non-target wildlife resources. The Refuge would implement, as needed, spatial or temporal closures to protect sensitive non-target wildlife resources. If refuge closures do occur, the general public would be notified of closure dates via press releases to local media, and the refuge website.		✓	✓
Create a tear sheet with map for hunters and post printable PDF file on refuge website.		✓	✓
Improve signage for hunting areas, access roads, and parking areas.		✓	✓

Rationale, Objective 5.4: Hunting:

Migratory game birds. Camas NWR has a history of providing quality waterfowl and upland game hunting opportunities. In the 1950s and 1960s, when plentiful water resources allowed the Refuge to keep ponds flooded well into the fall, local hunters viewed the Refuge among the best waterfowling in the area. Currently approximately 2,510 acres of the Refuge's wetland/meadow areas are open to migratory game bird hunting. A major management issue is that due to the falling water table in the region, the Refuge cannot provide enough water to fill all the wetlands that exist within the refuge boundaries. This is the case with the areas open to waterfowl hunting. Water may be present during the spring, but it typically cannot be maintained throughout the summer and into the hunting season. Due to lack of reliable fall water, use of Camas NWR for migratory game bird hunting is very limited, estimated at 4 to 8 hunter visits per season. When this plan is reviewed in five years, after the changes in water management described in the CCP are initiated, we will re-evaluate the size and location of the waterfowl hunt area. Depending upon wetland response to changes in water management we may consider shifting the waterfowl hunt units into areas with more reliable fall water, or enlarging the waterfowl hunt area. At that time consideration will also be given to maintaining closed areas for migratory birds to rest and gain necessary energy to continue migration. Areas open to migratory bird hunting would not exceed 40% of the total refuge acres. This is in accordance with the National Wildlife Refuge System Administration Act (16 U.S.C. 668dd(d)(1)(A); the Migratory Bird Treaty Act (16 U.S.C. 703-712); and the Migratory Bird Conservation Act (16 U.S.C. 715a-715r), which state that "If a refuge, or portion thereof, has been designated, acquired, reserved, or set apart as an inviolate sanctuary, we may only allow hunting of migratory game birds on no more than 40 percent of that refuge, or portion, at any one time unless we find that taking of any such species in more than 40 percent of such area would be beneficial to the species."

Upland game birds. Greater sage-grouse are a resident native game species. Loss of quality sagebrush habitat in the surrounding area has led to a decline in the number of sage-grouse on the Refuge. Greater sage-grouse populations are cyclic and the Table Butte population, which uses Camas NWR as part of its range, demonstrates this with total male count on lek varying from 77 to 343 over a fifteen-year time frame (IDFG 2011a). Sage-grouse are a Candidate Species for listing under the Endangered Species Act, but are still hunted throughout most of their range. Although literature is mixed on whether hunting is compensatory (the proportion of the population that was harvested would die from some other factor if hunting did not occur) or additive (number harvested adds to those that die from other causes), hunting of sage-grouse is permitted in Idaho. Presently IDFG sets the hunting season every August after examining population data and comparing them to the thresholds set in the statewide conservation plan. In recent years the Refuge has supported few sage-grouse within its boundary during the hunting season. For this reason Camas NWR may only receive one or two visits annually by hunters pursuing sage-grouse.

Ring-necked pheasants and gray partridge were introduced to the area and are not native to North America. In the 1970s and 1980s pheasant numbers were high, but have declined in the last several decades. One of the reasons for this decline is the change in agricultural practices in the area. Prior to the 1990s most of the agriculture was flood irrigation with ditches, relatively small fields, and consequently, abundant edge habitat (e.g. brush and tall vegetation) used by pheasants for thermal and security cover. With the shift to center-pivot irrigation, fields are larger with fewer ditches. Consequently, there is very little edge habitat. This has had a devastating effect on the pheasant population and it has not recovered to the high populations of the earlier years. Despite the fact that the population is low compared to historic highs, it is stable, in the cyclic pattern of this species. Populations of gray partridge have met the same fate as the pheasants, with local changes in agricultural practices. As with most upland game bird species, gray partridge populations are cyclic and in recent years, populations on the Refuge have been low but stable. In recent years an estimated 6 to 12 hunter visits come to the Refuge to hunt pheasant, while hunting of gray partridge is largely opportunistic.

Changes in habitat management called for in the CCP may bring a change in vegetation cover that may improve winter survival of pheasants and thus might potentially improve hunting opportunities. If good nesting and brood rearing conditions exist for several consecutive years, pheasant and partridge numbers could return to a level that would make the Refuge more attractive to upland game bird hunters.

Elk. In the past two decades incidental counts of the number of elk using Camas NWR as a safe haven, have been on the increase. A trend throughout elk range in the western U.S. is that the number of elk in urban or "refuge" settings is increasing due to availability of forage, adaptability of elk to new habitat, and safety from hunting pressure. Unfortunately, this adaptability has caused conflicts between elk and people (e.g., depredation to farms and feedlots, safety hazards on roads). As elk numbers grow on Camas NWR, the issues seen in other locations are beginning to occur here.

Elk are found throughout refuge habitats, and during certain times of the year they are the most numerous big game species on the Refuge. It is estimated that the Refuge supports from 0 to 150 elk seasonally. The numbers are typically highest in the fall and winter and lower in the spring and summer. The bulk of the elk spend their time south of the auto tour route, primarily around Rays Lake. It is felt that some of these elk are a resident herd while other elk are using the area solely as a wintering ground.

Camas NWR lies within IDFG's Snake River Zone (Game Management Units 53, 63, 63A, 68A). The boundary of Camas NWR lies within the GMU 63 of the Snake River Zone. IDFG estimated a population of 380 elk in the Snake River Zone in 2011 (IDFG 2011b). Agricultural depredation is a significant concern in GMU 63 (IDFG 2010). Consequently, for the past fifteen years or so this unit has had one of Idaho's longest, most liberal (5 months long, August 1-December 31) elk hunting seasons. The Draft Idaho Elk Management Plan 2014-2024 (IDFG 2013) does not specify a numeric population objective for elk in the Snake River Zone. IDFG's proposed 10-year management direction for the Snake River Zone is as follows: "Management direction in the Snake River Zone involves decreasing the current elk population. The zone is dominated by agricultural lands and small communities that are not compatible with large numbers of resident elk. It is proposed to continue managing for minimal elk numbers by using long, liberal hunting seasons and prompt responses to crop and property damage on agricultural lands" (IDFG 2013).

The objectives of the proposed elk hunt on Camas NWR are: 1) To offer quality recreational hunting opportunities; 2) to maintain and improve riparian habitat condition on the Refuge; and 3) to assist the

IDFG in reducing the elk population locally, in order to alleviate depredation concerns on surrounding private lands. The proposed hunt is intended to offer a quality and unique elk hunting opportunity that prioritizes youth and mobility impaired hunters. The hunt would offer a reasonable opportunity to harvest elk. By using an access permit process, a quality limited-entry elk hunt can be provided. An established number of permits (up to 20 annually) would allow for low hunter density within a limited hunt area footprint of 4,112 acres. By reducing the elk hunter density, the program would promote quality, safety, and uncrowded conditions; and would also allow hunting pressure to be distributed over a longer period of time.

Hunting may improve riparian habitat condition on the Refuge, both by direct reduction of herd size and by dispersing elk from riparian habitat. The elk hunt would help alleviate localized depredation issues on nearby agricultural lands by reducing the elk population, and/or dispersing elk onto adjacent private or public (BLM) lands where they may be hunted. The Refuge has coordinated closely with the State in developing an elk hunt that falls within frameworks for the general elk hunt within GMU 63. The Preferred Alternative would assist IDFG in supporting population objectives for the Snake River Management Zone, specifically as it applies to alleviating depredation to agricultural croplands. The proposed elk hunt would occur on 4,112 acres of the Refuge, generally described as the southern and western portion of the Refuge, south of the core wetlands and auto tour route, and west of Camas Creek. This area includes, and overlaps with, the current south waterfowl and upland game bird hunt unit (1,530 acres).

The proposed elk hunt has the potential to disturb sandhill cranes, since Rays Lake (an important pre-migration staging area) is included within the proposed elk hunting area. Sandhill cranes have shown susceptibility to even low levels of disturbance at roost sites (Bettinger and Milner 2000; Littlefield and Ivey 2000). Because of the sensitivity of roosting cranes to disturbance, hunters must maintain a distance of at least 400 m (¼ mile) from roosting cranes. The Refuge may also selectively close areas, as detected, to prevent abandonment of sandhill crane roosts and protect sensitive wildlife resources within the hunt area. As closures are implemented, the Refuge would supply elk hunt permit holders with maps of closures to hunting activity. All elk hunters would be required to attend a pre-hunt orientation where they would be advised of the location of sandhill cranes and other sensitive wildlife resources, and setback distances and/or area closures.

With a maximum of 20 elk hunting access permits issued annually, and a maximum of only two elk hunters allowed on the Refuge at any one time, conflicts between elk hunters and nonconsumptive users of the Refuge are expected to be minimal. The 6.3-mile auto tour route and 1.3 mile birding trail and observation deck, where the majority of nonconsumptive uses occur, are in the “no hunting” area and outside the elk hunt unit boundary. Currently few visitors use the proposed elk hunting area. In the Preferred Alternative, off-road hiking (other than by hunters with valid State licenses during the hunt season) would no longer be allowed on the Refuge. While this is proposed to minimize wildlife disturbance, this measure would also help reduce potential conflicts between elk hunters and other refuge visitors, and ensure visitor safety. The general public would still be allowed to use the 6.5 miles of hunter access roads, however currently few visitors, other than hunters, use these roads. Access roads to hunt units would be clearly signed so that all visitors understand that they are entering the elk hunt area. Enforcement of existing State regulations that prohibit discharge of firearms from or across public right of ways would minimize risk of trajectories into the non-hunting portion of the Refuge.

Objective 5.5: Friends Group and Volunteers			
Over the 15-year lifetime of the CCP, build a strong, actively engaged Friends Group which supports the Refuge's biological and visitor services goals and objectives.			
Strategies Applied to Achieve Objective	**Alt 1 Current**	**Alt 2 Preferred**	**Alt 3**
Hire a Park Ranger or Visitor Service Manager to assist with recruiting, assisting, and training the Refuge's Friends Group and volunteer workforce. (Also see Objectives 5.1, 5.3)		✓	✓
Create an on-site staff position (Park Ranger and/or Visitor Services Manager) to develop and deliver outreach and visitor services programs, manager volunteer program and develop partnerships (also see Objective 5.3).		✓	✓
Assist the Friends of Camas NWR in growing its membership, through activities such as "membership drives" to enlist regular refuge visitors as Friends Group members, presentations to local interest groups and participation in community events.	✓	✓	✓
Develop a list of educational and biological projects and activities to assist the Friends Group in focusing and prioritizing their efforts.	✓	✓	✓

Rationale, Objective 5.5: Friends Group and Volunteers:

Friends Groups within the National Wildlife Refuge System have become numerous over the past ten years. Friends Groups essentially "adopt" individual refuges or complexes, advocate for their needs, and provide both financial and volunteer support to accomplish many essential tasks and projects. Friends Groups not only directly benefit refuges, but also empower members to become advocates for refuges, and conduct outreach that increases public awareness of, and involvement with, national wildlife refuges. This occurs both through direct contact and increasingly, through the Web and social media. Historically, Camas NWR has had many "friends" that performed a variety of tasks and work projects, but no official Friends Group. In 2011, a Friends Group for Camas NWR was formed and has received their 501(c)3 nonprofit status. It is important for the Refuge to support this new Friends Group since it will play a critical role in providing volunteer support for the Refuge's biological and public use programs, and as an advocate for protecting refuge wildlife and habitat.

The Refuge has had a small cadre of volunteers who have performed a variety of important services, including mapping, facilities maintenance, and conducting refuge tours. However, the Refuge's small staff limits its ability to recruit, train, and manage volunteers. A Visitor Services Manager position at the SE Idaho Complex, and a Park Ranger at the Refuge, would allow the Refuge to grow its volunteer program to perform a variety of tasks in important areas, including building and maintaining visitor facilities, conducting visitor services programs, and habitat restoration and management.

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Chapter 3
Physical Environment

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Chapter 3. Physical Environment

3.1 Climate

3.1.1 General Climate

Climate in the Camas NWR area is typical of the Intermountain West, being relatively dry with mild summers and cold winters. Temperatures exceeding 90°F are usually encountered only a few days each summer, while winter lows in the −30°F range are not uncommon. Precipitation averages less than 10 inches annually.

Southeast Idaho displays a more continental climate than that of the western and northern portions of the State. This is apparent in not only the somewhat greater range between winter and summer temperatures, but also in the reversal of the wet winter–dry summer pattern. The semiarid climate of the area yields annual precipitation ranging from 10 inches annually at lower elevations and up to 21 inches in the highlands and mountains, with a majority of the precipitation occurring in the winter and spring months. Summer precipitation is light and infrequent, and usually comes in the form of afternoon thundershowers brought on by the influx of moisture-laden air from the Gulf of Mexico and the Caribbean region.

Annual temperatures vary from highs of about 88ºF to lows of 11ºF in the Snake River Plain, to highs of 79ºF and lows of 3ºF in the highlands. Seasonally, winter temperatures can be well below 0°F, especially when influenced by northern Canadian air flows, but frequent southwest winds can moderate cold winter conditions. Spring and fall temperatures can vary widely, with daytime temperatures typically ranging between 30 to 70°F. Summer temperatures frequently rise into the 90°F range, but long periods of extremely hot weather are not common. Summer night temperatures frequently drop into the 50 to 60°F range. The growing season (freeze-free duration) is about 125 days and shorter in other higher elevation areas, including the eastern valleys (Bureau of Land Management [BLM] 2009).

The climate of Idaho is largely governed by the Continental Divide of the Rocky Mountains, lying far to the east, and the maritime winds of the Pacific Ocean, more than 300 miles to the west. However, southeast Idaho has a more continental climate than the rest of the State. Summer winds from the south bring moisture from the Gulf of Mexico and the Caribbean, along with thunder, lightning, and rain. Summer monsoonal moisture intrusions are infrequent and significantly modified by the arid Great Basin of Utah and Nevada (NWS 2010).

At present, the climate becomes warmer and drier when moving south from the northern Rockies and Upper Columbia Basin to the southern Rockies. Climate in the ROCO region is influenced by the Rocky Mountains, which present a barrier to the westerly flow of the atmosphere carrying moisture from the Pacific Ocean. On the east side of the Rockies, winter precipitation is generated from polar continental air flows and warmer maritime air from the Gulf of Mexico colliding with the mountains (Ashton 2010). In the summer, the northern Rockies may continue to receive moist Pacific air, but the southern and central Rockies receive dry continental air or monsoonal flows from the Gulf of Mexico and Gulf of California (Kittel et al. 2002). Total annual precipitation and January precipitation are greater in the northern Rockies than in the central and southern Rockies. January temperatures in the northern Rockies and Upper Columbia Basin tend to be slightly warmer than those of the central Rockies (Kittel et al. 2002).

Southeast Idaho experiences four distinct seasons, with summers generally mild, but winters long and often harsh. Arctic air can contribute to the severity of winter bringing temperatures well below zero for extended periods. The valleys can also experience inversions when air quality can become a health issue due to the lack of circulation of air.

During winter, brisk southwesterly winds often persist for days or weeks. These winds may moderate cold winter conditions, producing unusually mild temperatures compared to surrounding areas. There are usually a number of days each winter when temperatures remain below freezing. Subzero temperatures usually occur only a few days each winter. During especially cold outbreaks, snowfall may accumulate to a depth of several feet or more. Cloudy and unsettled weather is common during the winter with measurable precipitation occurring on about one-third of the days (NWS 2010).

Spring months are normally wet and windy. Winds of 20 to 30 mph may persist for days at a time. Weather conditions fluctuate quickly during the spring. Afternoon temperatures in the 30s and 40s with precipitation in the form of rain or snow may occur after a period of sunny skies and afternoon temperatures in the 60s or 70s. Thunderstorms are not uncommon, and are usually accompanied by rain showers and occasional snow. Low elevations snowpack usually melts quickly during the spring, but high elevation snowpack can persist into late June (NWS 2010).

Summer may begin suddenly with a rapid change to warm and dry weather. Home heating is usually not required after the first week in June, but chilly nights can persist into early July. Showers and/or thunderstorms are common from late spring through summer. These storms often produce very localized precipitation. Thunderstorms are seldom severe, and tornadoes occur infrequently in the area. Brief heavy rain, lightning, small hail, and gusty winds may cause very localized damage at times. Long periods of excessively hot weather in July and August are uncommon. Afternoon temperatures often rise into the 90s, however low humidity usually results in overnight temperatures in the 50s or even cooler. The average growing season in Pocatello is around 120 days, extending from late May to late September (NWS 2010).

Autumn ushers in cooler weather with daytime highs generally in the 70s in early fall dipping into the mid-40s by mid-November with generally dry conditions. Autumn storms are usually very fast moving, and seldom persist for more than a few days. Sunny, warm days with cool nights are delightful for outdoor activities. Continuous home heating is seldom needed until mid-October. The first cold wave with highs below 20 and lows around 0 or lower may arrive anytime between late November and late December (NWS 2010).

Temperature and Precipitation

Camas NWR lies in the northeast corner of the Upper Snake River Plain at an elevation of approximately 4,800 feet. Temperatures have a wide range between summer and winter, and between day and night. Temperature and precipitation data from the Parameter-elevation Regressions on Independent Slopes Model (PRISM) (Daly 2002; Daly et al. 2008) were compiled for the Camas Water Resources Inventory Assessment (U.S. Fish and Wildlife [USFWS] 2011). PRISM provides a complete record (no missing data) of monthly temperature and precipitation data at 4-kilometer (km; 2.5-mi) resolution for the entire conterminous United States. Table 3.1 presents average monthly precipitation and average monthly minimum and maximum temperature from PRISM for the period 1971 to 2000 for the area within the refuge boundary. Average annual precipitation for the Refuge is 9.8 in/yr and the average annual temperature is 42.4°F. The coldest month is January with an average maximum temperature of 27.91° F and an average minimum temperature of 5.9°F. The warmest month is July with an average maximum 85.48°F and an average minimum temperature of 47.95°F.

Annual total precipitation averages 9.8 inches with May receiving the most (1.5 inches) and February the least (0.52 inches). About 25 percent of total annual precipitation falls in May and June. Data collected by the National Weather Service at the Hamer 4 NW weather station between 10/25/1948 and 12/31/2005 record annual total snowfalls averaging 27.6 inches, with two-thirds of annual snowfall occurring December through February. December has the highest average snowfall with 7.7 inches.

Table 3.1 PRISM Monthly Normals for Camas NWR (1971-2000)

Month	Precipitation (in)	Min Temperature (F)	Max Temperature (F)	Average of Min and Max Temp (F)
January	0.64	5.91	27,91	16.9
February	0.52	11.43	34.30	22.9
March	0,72	21.08	45.16	33.1
April	0.85	28.60	58.30	43.5
May	1.51	36.85	67.49	52.2
June	1.18	43.56	76.84	60.2
July	0.88	47.95	85.48	66.7
August	0.77	46.41	85.19	65.8
September	0.66	37.61	74.39	56.0
October	0.67	27.73	60.87	44.3
November	0.74	18.04	41.41	29.7
December	0.68	6.47	29.02	17.7
Total Precipitation	**9.81**			
Average Temperature		**27.64**	**57.19**	**42.4**

Floods

Riverine flooding is a threat, especially when spring rains compound with snowmelt runoff to peak the volumes of water coursing through stream channels to exceed their bearing capacity. The main flood-prone season in Jefferson County is during the spring and early summer months of April, May, and June. The primary cause of flooding during this time is snowmelt. However, a rare climatological occurrence during the winter months can cause the most severe floods. Several days of warm temperatures followed by rains can send floodwaters from snowmelt augmented by lack of percolation due to frozen ground into the county during January or February. In addition, thunderstorm activity during the summer months can cause havoc in the smaller tributaries.

Camas and Beaver Creeks are sources of surface inflow to Mud Lake, southwest of the Refuge, which has no effective outlet other than irrigation canals, evaporation, and seepage. Lands along Camas Creek near the lake and along the south side of the lake are susceptible to flooding (Idaho Bureau of Homeland Security 2010). Water levels in Mud Lake reached record levels in spring 1984 after two years of above normal precipitation in the watershed (1982-1984). The *Spokane Chronicle*

(1984) reported that Mud Lake area residents had "living with a daily threat of flooding for the last two months." It reported that the Mud Lake dam was being improved with additional fill material and a spillway channel southwest of Mud Lake was improved. On Wednesday, June 20, a 30-foot section of dike failed and flooded 2 square miles of farmland before being plugged (*Milwaukie Journal* 1984).

Flash flooding may also occur. Warm season convection is typically associated with precipitation minima in the Great Basin (Mock 1996) and specifically in the Snake River Plain of eastern Idaho (Andretta 1999). However, climatological anomalies in monthly summer rainfall can occur in eastern Idaho due to the poleward intrusion of the summer monsoon from the desert southwest United States into the Great Basin (Higgins et al. 1997; Higgins et al. 1999). For example, on July 18, 2004 a subtropical air mass permeated Utah and Idaho, leading to heavy rains in eastern Idaho. Several successive days of heavy rainfall in the region led to the issuance of flash flood watches and warnings (Andretta 2006).

Wind and Severe Weather Events

The topography of the Eastern Snake River Plain (ESRP) funnels the strong westerly winds typical of mid-latitude North America. This produces dominantly northeast-directed winds in the ESRP (Phillips 2012). Winds within the Snake River Plain are usually from the south and south west, light and variable, and largely result from the daily heating and cooling of land surfaces. The ESRP is characterized by near surface winds that trend generally throughout the year from SW to NE (Clawson et al. 1989). On average, the frequency of high wind events is greatest in spring and summer, with fall being calmer, and winter the calmest season (Clawson et al. 1989).

Windstorms are fairly common in Idaho and have resulted in disruptions of power, but usually only minor damage to structures. The strongest winds generally are associated with weather fronts and the thunderstorms that occur in spring and summer. With that comes the threat of lightning, rain, and hail. These events are generally limited in duration, but 40 to 60 mile per hour (mph) gusts are possible (BLM 2009). By exposing soil, both agricultural practices and range fires contribute to dust storms in the area. These occur more often in spring prior to agriculture planting, and in late summer/fall after harvest. Wind erosion can be severe at these times and the problem can be compounded if farmers have burned their crop residue. Blowing soil and dust have been severe enough to close major roadways (BLM 2009).

Idaho does not have hurricanes and very few tornadoes. From 1880 to 2000 there have been only twelve tornadoes in Jefferson County, where Camas NWR is located. These tornadoes occurred on July 8, 1980, April 11, 1985, June 29, 1987, March 23, 1988, two on April 17, 1988, June 4, 1991, June 7, 1992, two on June 15, 1993, May 31, 1997 and July 17, 2000. The severity of these storms on the Fujita Tornado Scale ranged from F0 (40-72 mph) to F1 (73-112 mph). No deaths or injuries were reported (Tornado Project 1999).

The 1955 Camas NWR annual narrative described a small tornado that passed through the headquarters area, damaging trees and power lines. This is not mentioned on the Tornado Project website, and may not have been a confirmed tornado.

3.1.2 Climate Cycles in the Intermountain West

In addition to the familiar daily, seasonal, and yearly fluctuations in weather, there are longer term natural variations in the Earth's climate. Climate can be defined as the "average weather," or more specifically, as "the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years" (IPCC 2007). Past variation in the Earth's climate has been cyclical, as opposed to being random or following linear trends.

Cycles in the Earth's climate are nested and on multiple time scales, from year to year (interannual) to decades, centuries, and millennia. Various cycles are caused by independent physical mechanisms. Thus, for example, there are major glacial (cold) and interglacial (warm) periods on multimillennial time scales, caused by changes in the Earth's orbit around the Sun. Other cycles in the Sun's activity drive climate variations at the century scale. Cyclical patterns in circulation of the oceans and atmosphere lead to decadal (30 to 40 year) patterns, such as the Pacific Decadal Oscillation (PDO), which affects the west coast of North America. Cycles in the ocean-atmosphere system also lead to interannual variations in climate, such as the El-Niño/La Niña cycle (ENSO, for El-Niño Southern Oscillation). Climate at any one time is an expression of all of these nested mechanisms and cycles operating together (U.S. Forest Service [USFS] 2010).

El Niño/La Nina Southern Oscillation (ENSO) events are linked to ocean temperatures in the tropical Pacific and last 6 to 18 months. In El Niño years, ocean temperatures are warmer than average; in La Nina years, cooler. A single warm or cool PDO phase lasts 20 to 30 years, and the strongest signal for the PDO is in the north Pacific. 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. This additive effect is also seen in the region's streamflow and snowpack. 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 (Climate Impacts Group 2009).

During La Niña events, winters in the northwestern U.S. tend to be colder and wetter than average, and winters in the southwestern U.S. tend to be dryer and warmer than average (Goodrich 2007). The changes in storm tracks and weather events associated with ENSO can also influence other climate patterns. However, the teleconnections between ENSO and the other patterns are not as well understood as ENSO itself. During El Niño events, winters in North America tend to be warmer than average in the north and wetter than average in the south. The Intermountain West region is in an area that does not show a distinct anomaly due to El Niño (CPC 2005).

The PDO reflects decadal changes in sea surface temperatures (SST) in the northern or "extra-tropical" Pacific Ocean (Goodrich 2007; Mantua 2001). When the PDO is positive, the SSTs in the northern Pacific Ocean are colder than average, and when the PDO is negative, the SSTs in the northern Pacific Ocean are warmer than average precipitation tends to be above average in the southwestern United States and portions of the Intermountain West region. When La Niña and the positive PDO are in phase, and SSTs in the Pacific are below average, winter precipitation tends to be below average in the southwestern United States, including parts of Utah. Finally, during a negative PDO event and a neutral ENSO, winter precipitation is above average for most of the west (Goodrich 2007).

As part of their analysis of temperature and precipitation trends in the Camas NWR area (below), the USFWS Water Resources Branch also evaluated the correlation of precipitation and temperature with ENSO and PDO. Their examination of data from USHCN Ashton, ID indicated little or no correlation of precipitation or temperature with either ENSO or the PDO (USFWS 2011). This is supported by results from Redmond and Koch (1991) indicating that the area is neutral with respect to ENSO and only weakly correlated with the PDO.

3.2 Climate Change

Note: Much of the following section is derived from “Observed and projected ecological response to climate change in the Rocky Mountains and Upper Columbia Basin: A synthesis of current scientific literature” (Ashton 2010) and “Climate change, aquatic ecosystems, and fishes of the Rocky Mountain West: implications and alternatives for management” (Rieman and Isaak 2010).

A growing body of scientific evidence has emerged supporting the theory of human-caused global climate change. During the 20th century, the global environment experienced increases in average worldwide temperatures, sea levels, and chemical concentrations. Average annual air temperatures on the earth’s surface have increased by 1.3°F since the mid-19th century (Solomon et al. 2007). Furthermore, the increasing trend in global temperatures over the last 50 years is approximately twice the trend of the previous 50 years (IPCC 2007). Globally, during 11 of 12 years from 1995 to 2006, surface temperatures are the warmest on record since 1850 (IPCC 2007).

Climate change is having significant effects on organisms and ecosystems worldwide. Changes in the western United States have been particularly noticeable in the last century, with increases averaging 0.5 to 2°C (0.9-3.6°F) in mean annual temperatures, depending on elevation (Diaz and Eischeid 2007; Pederson et al. 2010). Warmer winters and springs have resulted in more precipitation falling as rain instead of snow, reduced snowpack, earlier snowmelt, earlier streamflow from snowmelt, an 8 to 10 day advance in the onset of spring on average across the West, more frequent large fires, and possibly an increase in insect outbreaks and plant mortality (Breshears et al. 2005; Cayan et al. 2001; Knowles et al. 2006; Mote et al. 2005; Pederson et al. 2010; Raffa et al. 2008; Stewart et al. 2005; Westerling et al. 2006).

The preponderance of evidence suggests that the magnitude of these changes has been influenced by human activity. Barnett et al. (2008) used nested climate and hydrological models to attribute most of these changes in the West to greenhouse gas emissions and their impact on global and regional climate. Another modeling study suggests that these changes are caused by a blend of anthropogenic forcing and Pacific and Atlantic decadal variability (Wang et al. 2008).

3.2.1 Predicted Future Ecological Trends in the Intermountain West

Projected temperature increases for the coming century are expected to increase the proportion of winter precipitation falling as rain, increase the frequency of winter flooding, reduce snowpack, increase winter streamflow, result in earlier peak streamflow, and decrease late spring and summer streamflows (Hamlet et al. 2007; Hamlet and Lettenmaier 1999; Mote et al. 2003; Mote et al. 2005; Payne et al. 2004; Tague et al. 2008). Unless otherwise noted, projected trends were abridged from Ashton (2010).

Temperature and Precipitation

Since 1900, temperatures have increased 0.5 to 2°C (0.9-3.6°F) in most areas of the western United States (Pederson et al. 2010; Mote 2003; Ray et al. 2008) but cooling has occurred at some sites (CIG 2010; Ray et al. 2008). The rate of change varies by location and elevation but is typically a 1ºC (2°F) increase since the early 20th century (Hamlet et al. 2007). Temperature increases are more pronounced during the cool season (Hamlet and Lettenmaier 2007). In the northern U.S. Rockies, annual rates of increase are roughly two to three times that of the global average (Bonfils et al. 2008; Hall and Fagre 2003; Pederson et al. 2010; Vose et al. 2005), a pattern that is evident at northern latitudes and higher elevation sites throughout the West (Diaz and Eischeid 2007; National Assessment Synthesis Team 2001). Rises in temperature appear to be accelerating where mean regional spring and summer temperatures for 1987 to 2003 were 0.87°C (1.57°F) higher than those for 1970 to 1986, and were the warmest since 1895 (Westerling et al. 2006).

Trends in precipitation in the Intermountain West Region are far less clear. Instrumental data from the last century show modest increases for much of the northwestern United States (Mote 2003; Mote et al. 1999; Mote et al. 2005), but no directional trends for parts of the southern Rockies (Ray et al. 2008). Natural variability in precipitation is evident in the instrumental record for all of the climate regions, and long-term drought conditions during the last century impacted large areas within the region. Although 20th century droughts had substantial socioeconomic and ecosystem impacts, there is ample evidence that they were not as severe, in terms of duration and magnitude, as a number of drought events that occurred during the last millennium (Cook et al. 2007, 2004; Meko et al. 2007).

Temperatures in the region are generally expected to increase by approximately 1 to 2°C (2-4°F) during the next 50 years with natural variation over years to decades. Precipitation is less well understood, but the projection for total annual precipitation suggests that the dominant pattern in North America will be a wetter climate in the northern tier and a drier climate in the southwestern United States. These and other predicted changes for the Rocky Mountains and Upper Columbia Basin are outlined in Table 3.1.

Air Quality

A warmer climate will make it more difficult to meet U.S. air quality standards, particularly for ozone (Field et al. 2007; Karl et al. 2009). Changes in climate affect air quality by changing wind patterns and ventilation rates, precipitation, dry deposition, chemical production and loss rates, natural emissions, and background concentrations (Jacob and Winner 2009). For instance, higher temperatures increase the oxidation of sulfur and N oxides, and precipitation changes will influence the distribution of acids deposited across the landscape (Bernard et al. 2001).

Some of the better understood effects from a warmer climate include increased ground-level ozone formation and increased particulate matter derived from forest fires. Ozone formation generally increases at higher temperatures due to increased gas-phase reaction rates (Aw and Kleeman 2003). The rate at which volatile organic compounds are produced from natural sources, such as trees, will also increase with increasing temperatures (Guenther 2002). This may be somewhat offset by the inhibitory effect of carbon dioxide (CO_2) on isoprene production (Young et al. 2009), as isoprene is one of the more significant ozone precursors emitted by vegetation. Most models find that even with current emission rates, there will be a widespread increase in ground-level ozone during the summer over the next century (Jacob and Winner 2009). This is consistent with historical data that show a consistent increase in ozone with temperature in polluted areas (Jacob and Winner 2009). In the West, however, decreases in background concentrations of ozone (due to increased water vapor) may offset increases in ozone due to temperature (Jacob and Winner 2009).

Biodiversity

With a 1°C (2°F) increase in average global temperature, the IPCC estimates that up to 30 percent of all species will be at increased risk of extinction (Field et al. 2007). While such models and estimates include uncertainties, there is little or no evidence that climate change will slow species loss (SCBD 2003). The Secretariat for the Convention on Biodiversity (2003) predicted four impacts on biodiversity as a result of climate change: (1) the climatic range of many species will move poleward or upward in elevation; (2) many species that are already vulnerable, such as rare endemics and threatened and endangered species, are likely to become extinct; (3) changes in the frequency, intensity, extent, and locations of climatically and non-climatically induced disturbances will affect how and at what rate existing ecosystems will be replaced by new plant and animal assemblages; and (4) some ecosystems, such as high mountain ecosystems, arid ecosystems, remnant native grasslands, and ecosystems underlain by permafrost, will be particularly vulnerable to climate change. Diversity will decline where habitats are found in small discrete patches, such as alpine tundra and lakes, and where warming contributes to habitat loss.

Productivity

Although primary productivity is projected to increase moderately due to longer growing seasons and elevated CO_2 concentrations, net ecosystem and biome productivity may decline due to increased disturbance, drought, and changes in community structure. While models project that a modest warming will lead to greater tree growth in the United States (Ryan et al. 2008), there will be spatial and temporal variations depending on other factors that limit productivity at a given site (Ryan et al. 2008). This may result in a pattern of initial gains in productivity followed by declines. The areal extent of drought-limited ecosystems is expected to increase by 11 percent for each 1ºC (2°F) of warming in the continental United States (Bachelet et al. 2001). For widespread species such as lodgepole pine (*Pinus contorta*), a 3ºC (5°F) temperature increase would increase growth in the northern part of its range, decrease growth in the middle range, and decimate southern forests (Rehfeldt et al. 2001). Where climate change leads to conversions of vegetation type (e.g., woodland to grassland), this will have strong impacts on productivity (Izaurralde et al. 2005).

Phenology

With continued warming, we should expect to see a continued advance of spring in the Intermountain West Region. Compared to 1950 to 1970, streamflow and peak snowmelt are occurring 1 to 4 weeks earlier (Stewart et al. 2005). Lack of good phenology data makes predictions difficult, but changes in the timing of spring will likely affect the timing of reproduction, emergence, and migration of numerous species, which may affect community structure and function. On the other hand, phenological events that are tied to day length, such as the emergence of many plants, are not expected to change.

While evolutionary adaptations to climate change can be rapid, it is generally thought that they are not rapid enough to counter the negative effects that climate change will have on many species (Parmesan 2006). One concern is the development of asynchronies among interacting and dependent species. For instance, there is the potential for increased stress for marmots in the early spring because while marmots are emerging earlier, there has been no change in the emergence of food plants in the area (Inouye et al. 2000). Mismatches in the phenology of birds and their prey have been documented in other parts of the United States and the globe and have been linked to population declines (Both et al. 2006; Wormsworth and Mallon 2008).

The key uncertainties in understanding the response of phenology to climate change lie in the rate at which phenological changes occur and how fast species will adapt to new seasonal regimes. Manipulative experiments suggest that other global changes, such as changing CO_2 concentrations and increased nutrient availability, may dampen the phenological response to warming (Cleland et al. 2006). As a result, it will be difficult to predict the magnitude and direction of response for many species. There are also apparent contradictions between individual species and ecosystem level responses (Steltzer and Post 2009). Moreover, it remains unknown how often and how many species interactions will be affected by the development of asynchronous life histories. Finally, the largest changes to date are related to earlier spring onsets; less is known about phenological changes to climatic trends in other seasons.

Wildland Fire

Most evidence supports that future climate changes will cause increases in the frequency, intensity, severity, and average annual extent of wildland fires (Field et al. 2007; Ryan et al. 2008). Models project that numerous aspects of fire behavior will change, including longer fire seasons, more days with high fire danger, increased natural ignition frequency and fire severity, more frequent large fires, and more episodes of extreme fire behavior (Bachelet et al. 2007; Brown et al. 2004; Westerling and Bryant 2008). The best evidence, however, is for increases in the average annual area burned (Bachelet et al. 2007; Flannigan et al. 2006; McKenzie et al. 2004). For instance, McKenzie and colleagues (2004) predict that a mean temperature increase of 2.2°C (4.0°F) will increase the annual area burned by wildfire by a factor of 1.5 to 5. In another study, it is predicted that the median annual acres burned in the Upper Columbia Basin and northern Rockies would increase from about 0.5 million acres (0.2 million hectares [ha]) in 1916 to 2006 to 0.8 million acres (0.3 million ha) in the 2020s, 1.1 million acres (0.4 million ha) in the 2040s, and 2.0 million acres (1 million ha) in the 2080s (Littell et al. 2009).

While there is strong evidence that climate change will increase the number of fires, and particularly the area burned each year, uncertainties remain. First, historical patterns of precipitation are linked to fire and synoptic weather features that drive fire growth, such as high pressure ridges and wind patterns, but models differ in their projections for these climate variables. Other factors, such as increases in non-native, annual grass invasions, may alter fire dynamics, making predictions based on climate alone difficult. Finally, and perhaps most importantly, if fires and other stand-replacing disturbances occur more frequently, the resulting landscape pattern may limit the size of future fires and total area burned (Collins et al. 2009).

Plant and Wildlife Disease

Climate change will likely increase the range, frequency, severity, and impact of plant and wildlife disease (Harvell et al. 2002). The IPCC states with very high confidence that climate change will increase the risk and geographic spread of vector-borne infectious diseases, including Lyme disease and West Nile virus, and changes in precipitation will increase water-borne disease (Field et al. 2007). Diseases will likely move farther north and into higher elevations. For example, the tick that causes Lyme disease, *Ixodes scapularis*, is limited by cold temperature, and models suggest that its range limit could shift north by 200 km (124 mi) by the 2020s and 1,000 km (621 mi) by the 2080s

(Ogden et al. 2006). In some cases, climate change may adversely affect the disease rather than the host. For instance, fungal diseases dependent on moist conditions may decrease in a warmer, drier future (Frankel 2008; Harvell et al. 2002).

Invasive Species

The spread and impact of invasive species is driven mainly by changes in land use, increasing urbanization, disturbance, and alteration in management practices, but climate change may exacerbate the extent of invasions. Climate change is generally expected to increase the spread of invasive species through direct effects on habitat suitability and the indirect effects of altered nutrient availability and disturbance regimes (Dukes and Mooney 1999). The IPCC has very high confidence that disturbances such as wildfire will continue to increase and this will facilitate invasions (Field et al. 2007). In general terms, invasive species are expected to differ in their response to climate change from native species because they possess traits such as broad climatic tolerances and robust dispersal mechanisms that enable them to better adapt to changing conditions. Hellman and colleagues (2008) identified five consequences of climate change on invasion dynamics: altered invasion pathways, changes in environmental constraints, altered distribution of existing invasive species, altered impacts of invasive species, and a change in management effectiveness. An example of an altered invasion pathway would be an increase in recreational boat traffic as a result of warmer temperatures in previously snow-covered areas resulting in an increase in the spread of nuisance species.

Here are some examples of how climate change is expected to alter invasion dynamics in the region.

- Stream temperatures are expected to warm with warmer air temperatures and lower flows, increasing the amount of suitable habitat for warm-water fishes by an estimated 31 percent nationwide (Mohseni et al. 2003).
- Warmer temperatures may increase the impact of invasive species. In the Columbia River, for example, increasing temperatures have caused smallmouth bass (*Micropterus dolomieu*) to consume more native salmon (Petersen and Kitchell 2001), and whirling disease is more virulent in warmer streams (Rahel and Olden 2008).
- Earlier melting of snowpack will alter streamflows, may increase disturbance and flood events, and favor invasive species. It is predicted that such changing conditions may increase rainbow trout (*Oncorhynchus mykiss*) invasions in Colorado (Fausch et al. 2001). However, native species such as cottonwoods could benefit from larger spring flood events that facilitate establishment and recolonization (Scott et al. 1996).
- Bradley and colleagues (2009) examined the current and potential distributions of five problematic plant invaders in the West (cheatgrass, knapweed, yellow star thistle, tamarisk, and leafy spurge) based on the current climatically suitable habitat and maps of future habitat based on an ensemble of global climate models. They found that precipitation was the most important predictor of plant distribution and that warming temperatures alone may have little effect on range expansion. Most species were expected to expand in some areas while contracting in others. For example, they predict that the risk of cheatgrass invasion will increase in Montana, Wyoming, Idaho, and Colorado, but decrease in parts of Nevada and Utah.

Table 3.2. Summary of Projected Climate Changes in the Rocky Mountains and Upper Columbia Basin*

Climate Variable	General Change Expected	Range of Change Expected	General Pattern	Confidence
Temperature	Increase	1.5-2.1ºC (2.7°-3.4°F)	Increases slightly greater in the summer	High
Precipitation	No change	2-5% increase in winter, 0-4% decrease in summer	Increase in winter, decrease in summer	Moderate for winter; low for summer
Drought	Increase in frequency and severity	Varies with magnitude of temperature and evaporation change	Greatest impact in summer	High
Temperature Extreme Events	Increase of warm events, decrease of cold events	Varies with magnitude of tem-perature change	Increase in frequency and length of hot events	High
Precipitation Extreme Events	Potential for decreased frequency coupled with increased intensity	Uncertain	Potential for more intense spring and summer floods	Uncertain

* based on McWethy et al. in press, in Ashton 2010.

3.2.2 Effects of Climate Change upon Intermountain West Communities

Warming temperatures and changing precipitation regimes will likely alter plant and animal communities throughout the region. Since the timing and magnitude of response to climate change is certain to vary by species, future community assemblages may not have current analogs. Below are concepts that are common across all communities and discuss some of the more specific observed and projected responses to climate change for wildlife species and sagebrush, grassland, and wetland ecosystems.

Sagebrush and Grasslands

Over the short term, the greatest threats to grasslands and sagebrush ecosystems come from oil and gas development, increasing urban and agricultural development, and invasive species. However, wildfires are increasing and likely to intensify in a warmer future with drier soils, longer growing seasons, and more severe droughts (Field et al. 2007), and these may cause large changes in grassland and sagebrush ecosystems. Direct impacts on big sagebrush, a keystone species throughout its range, may also be severe (Smith et al. 1997). The species is not fire tolerant and once removed from large disturbances, is very slow to recover (Smith et al. 1997). Weed invasion typically follows removal of sagebrush (Prevey et al. 2010), and this disturbance will likely be exacerbated by drought-induced stress on the species (e.g., Poore et al. 2009).

Modeling suggests that climate change will likely increase net primary production in grasslands and decrease soil carbon, but high annual variability in plant production makes these projections uncertain (Parton et al. 2005). Nutrient cycling and plant production are expected to occur more rapidly in response to climate change than changes in community composition (Parton et al. 1994).

Climate change is also expected to cause major changes in grassland and sagebrush distribution across the landscape (Bachelet et al. 2001). Range expansions of woody species are predicted to continue, particularly the expansion of pinyon-juniper into sagebrush steppe and grasslands (Rowland et al. 2008), resulting in a decrease in sagebrush and an increase in woodlands across the West. Changes in grassland cover are more subtle, but cover is generally predicted to decrease (Bachelet et al. 2001). Kremer et al. 1996, who used an earlier generation of downscaled global circulation models to predict the response of warming and reduced precipitation scenarios in eastern Washington, suggested that native sagebrush would decline and a less productive, invasive annual–dominated grassland would persist or increase. Such a shift has major implications for sagebrush-obligate vertebrates such as certain bird species (Knick et al. 2005). Climatic suitability models suggest that by 2100 sagebrush communities in Nevada, southern Idaho, Utah, Colorado, and eastern Wyoming may be at risk of loss due to climate change; regions in southwestern Wyoming will be at less risk (Bradley 2010).

There are a number of uncertainties in projecting the response of grasslands and sagebrush to climate change. First, regional, elevational, and grassland type may strongly influence response. A recent estimate of the velocity of climate change across biomes found that temperature changes will occur much more quickly in xeric shrublands and flooded grasslands than in other biomes, and much more slowly in montane grasslands (Loarie et al. 2009). Second, the magnitude and velocity of changes caused by the strong link between invasive species, fire, and grasslands and sagebrush is difficult to estimate. Third, precipitation and drought rather than temperature will likely drive changes in grasslands, and they are more difficult to predict. Fourth, the future impact of grazers is difficult to estimate, particularly as grassland fragmentation increases. Finally, many grassland and sagebrush systems are actively managed through livestock grazing, invasive species control, and prescribed and suppressed fire.

Aquatic Resources and Wetlands

Climate change will significantly impact regional aquatic resources and will likely make it more difficult to achieve water quality standards nationwide (Field et al. 2007). While there are likely to be regional variations, projected effects across the West include loss of glaciers, less snow, earlier peak flows, less streamflow, warmer water temperatures, more frequent droughts, and more intense storms.

At the current rate of melting, it has been suggested that the Glacier National Park’s remnant glaciers will be gone in the next 25 to 30 years (Hall and Fagre 2003) due to increases in summer temperatures and a reduction in winter snowpack. Streamflow may increase during this initial period of melt, but flows will decline when the glaciers disappear (Morris and Walls 2009). Total winter precipitation may increase but overall snowpack is projected to decline throughout the West. For example, with a 4ºC (7°F) temperature increase and doubling of atmospheric CO_2 in Loch Vale Watershed at Rocky Mountain National Park, models predict a 50 percent reduction in snowpack and 4 to 5 week earlier increases in soil moisture and runoff compared to mean onset of spring conditions from 1984 to 1998 (Baron et al. 2000).

The loss of winter snowpack will greatly reduce the major source of groundwater recharge and summer runoff, resulting in a potentially significant lowering of water levels in streams, rivers, lakes, and wetlands during the growing season (Mote et al. 2005; Barnett et al. 2008). With warmer temperatures and increasing droughts, municipal and agricultural demands for water are likely to increase, drawing down freshwater resources even further (National Assessment Synthesis Team 2001). Lower summer base flows reduce the amount of instream habitat for invertebrates and fish and cause a reduction in stream-side groundwater tables which are important for sustaining riparian vegetation communities (Scott et al. 1999; Stromberg et al. 1996). Reduced water depths may also increase the vulnerability of sensitive species (e.g., amphibians) to harmful ultraviolet radiation (Kiesecker et al. 2001).

In addition to the shift in the quantity of water, climate change may reduce water quality due to increased erosion and decreased dilution of pollutants. Decreases in snow cover and more winter rain on bare soil are likely to lengthen the erosion season (Walker et al. 2001), which could lead to average phosphorus concentrations in streams increasing 25 to 35 percent (Walker et al. 2001). Predicted increases in the severity and frequency of floods may also contribute to increases in erosion, as well as affect ecological processes that are sensitive to changes in the probability distributions of high flow events such as habitat stability, biodiversity, and trophic structure (Hamlet and Lettenmaier 2007; Konrad and Booth 2005). Degradation of water quality will likely lead to a reduction in or loss of sensitive stream species (Waters 1995).

Warming air temperatures and a reduction in glacial inputs will lead to warmer water temperatures across the West. Surface and bottom water temperatures of lakes, reservoirs, rivers, and estuaries are projected to increase from 2 to 7°C (4-13°F) (Fang and Stefan 1998, 1999; Gooseff et al. 2005; Hostetler and Small 1999). Warmer waters may lead to oxygen depletion, a change in fish distribution, an increase in algae and zooplankton in coldwater lakes, and a loss of some species. Species that are isolated in habitats near thermal tolerance limits or that occupy rare and vulnerable habitats like alpine wetlands may become extinct (Williams et al. 2007), and fish such as trout that are dependent on cool waters will likely decline (Pederson et al. 2010; Williams et al. 2009). In contrast, many fish species that prefer warmer water, such as largemouth bass and carp, may expand their ranges if surface waters warm (Battin et al. 2007). Warmer waters may also cause aquatic diseases and parasites to become more widespread (Hari et al. 2006).

Wetlands are among the most significantly altered ecosystems in North America due to stressors such as changes in hydrology from flow regulation, groundwater pumping, fill placement, overgrazing by domestic and native ungulates, atmospheric deposition, and biological invasion (Patten 1998; Zedler and Kercher 2005). Over the last 200 years, wetland areas have declined approximately 56 percent in Idaho, 50 percent in Colorado, 38 percent in Wyoming, and 27 percent in Montana (OTA 1993). Like other freshwater ecosystems, wetlands are considered extremely vulnerable to climate change, which is projected to diminish their number and extent and cause a decline in associated flora and fauna (Field et al. 2007). Wetlands are already facing widespread degradation so that even small reductions in precipitation could exacerbate wetland loss.

A few of the wetland types considered at greatest risk globally are found in the Intermountain West Region including riparian wetlands in arid zones, peatlands, and alpine wet meadows (Burkett and Kusler 2000; OTA 1993). But despite the recognition of the increasing role of climate change in altering wetland functions (e.g., Baron et al. 2000), there is a paucity of studies in the ROCO region that document climate-driven declines in wetland function or extent. One exception is a recent article describing changes in hydrology leading to wetland desiccation in Yellowstone National Park (McMenamin et al. 2008). Currently, the biggest losses are in the marshes on Yellowstone's northern range. It is expected that loss of wetlands will result in a corresponding loss in biodiversity and critical functions such as carbon storage in peat and water storage (OTA 1993).

Warmer temperatures will affect the growth and reproduction of wetland species by increasing decomposition rates and evaporation from wetlands and their water supplies, reducing peat accumulation, and thawing upper layers of permafrost in alpine wetlands (Burkett and Kusler 2000; OTA 1993). Where warmer temperatures lead to increased fire severity and extent, peat bodies, particularly those in a matrix of forest, will be at risk. Where warmer temperatures cause an increase in wetland decomposition rates and reduce peat accumulation, carbon storage will be reduced.

Greater changes in wetlands are expected to result from altered precipitation as it affects soil and vegetation conditions (Winter 2000). Many models project wetter winters in the Region, but any positive effect of increased winter flows for wetlands is expected to be outweighed by drier summers and warmer temperatures. It is predicted that wetlands response will first become evident in water table changes and alterations in the formation and duration of soil anoxic conditions. Alterations in the composition of short-lived and then longer-lived perennial plants will follow. Soils may be altered after many decades unless fire occurs. Alterations of plant cover and soil permeability may act in a feedback loop to further modify the hydrological cycle. Some wetlands, such as forest wetlands and wet meadows, are particularly sensitive to hydrological changes and a reduction in the water table of a few inches could convert wetlands to upland habitats (Kusler 2006).

Reduced groundwater flow due to lower snowpack, earlier melt dates, or reduced summer precipitation could result in lower water tables in wetlands dependent on groundwater inputs (Poff et al. 2002). Riparian wetlands will be sensitive to precipitation because changes in the timing and magnitude of flooding will affect the flux of water, nutrients, sediment, and biota between main river channels and riparian wetlands (Hauer et al. 1997).

Wildlife

There are numerous uncertainties involved in predicting wildlife responses to climate change, the largest being that associated with vegetation change. Shifts in vegetation and habitat availability, whether caused by climate or land use change, will have strong impacts on wildlife populations. Another uncertainty results from the lack of the basic life-history data needed to estimate vulnerability. How biotic interactions will be altered and to what degree this will affect populations remains unknown. Phenotypic plasticity and behavior adaptations may allow species to respond to change in unpredictable ways. The responses of wildlife to non-climate stressors such as fire, disease, and invasive species may dampen or strengthen responses to climate change.

There is evidence that warmer temperatures and changes in precipitation have caused range shifts, asynchronies, altered migration and hibernation patterns, increases in disease prevalence, and ultimately a reduction in the population size of many species (Root et al. 2003; Walther et al. 2002). Moreover, climate change can strongly affect animal populations through its effects on disturbance regimes, disease, land use, and invasive species. The predicted responses of wildlife to climate change are that:

- Many species' ranges will move northward and upward in elevation.
- Species will respond differentially, creating non-analog communities and asynchronies among interacting species.
- In most cases, climate changes will be more rapid than evolutionary adaptations.

- Species that are mobile, genetically diverse, show wide physiological tolerances, and have generalist diets will respond the most positively.
- Temperature-limited and snow-adapted species are at particular risk to a changing climate.
- Wildlife associated with habitat types and communities such as spruce-fir, alpine and sagebrush that are expected to decline are at greater risk.

3.2.2 Observed Changes to the Refuge Area

Temperature and Precipitation

In 2011 the USFWS Water Resources Branch (Region 1, Portland, OR) compiled and analyzed temperature and precipitation data from the closest USHCN climate monitoring site to the Refuge (Ashton, Idaho, located about 60 miles east of the Refuge). The USHCN is a network of climate monitoring sites maintained by the National Weather Service (Menne et al. 2011). Sites in the network are selected because their location and data quality make them well suited for evaluating long-term trends in regional climate. The Ashton site is wetter because it is about 1,000 feet higher in elevation than the Refuge. But air temperatures are comparable and the trends and monthly distribution of precipitation and air temperature for the two sites should be similar and representative of the area.

They used the PRISM (Daly 2002; Daly et al. 2008) to analyze temperature and precipitation data to determine long-term trends from 1925 to 2010. PRISM provides a complete record (no missing data) of monthly temperature and precipitation data at 4-km (2.5-mi) resolution for the entire conterminous United States.

Monthly air temperature and precipitation at Ashton, ID are shown in Figure 3.1. Temperatures are coldest in December and January and warmest in July and August. Mean air temperature at Ashton, ID is about 42°F, similar to the Refuge. Monthly precipitation is relatively evenly distributed throughout the year with slight increases during the winter and again in May and June. Southeastern Idaho is somewhat unique with these two precipitation peaks as compared to the rest of the State, which typically has one winter peak in precipitation. The average annual precipitation for Ashton, ID is about 20 in/yr, which is more precipitation than the Refuge receives annually.

Total precipitation and average temperature at Ashton, ID for water years 1925 to 2010 are shown in Figure 3.2 and Figure 3.3 below. Annual average temperatures have increased 1.5°F (0.18°F/decade) from 1925 to 2010 and that increase is statistically significant ($p=0.004$). Annual monthly minimum temperatures have increased even more (2.2°F over the period or 0.26°F/decade, $p=0.000$) but maximum temperatures show no statistically significant change. Total precipitation has increased slightly over the period, however, the increase is only weakly significant ($p=0.075$). The more substantial change has been an increase in the variability in total precipitation in the area. A similar pattern has been observed in precipitation and streamflow elsewhere in the western U.S. (Pagano and Garen 2005).

The observed temperature increases are very similar to increases described in other studies. McWethy et al. (2010) reported that average annual temperatures in the Upper Columbia Basin show increases of 1.2 to 1.4°F for the period 1920 to 2003. Mote et al. (2005) reported that regionally averaged temperatures in the Pacific Northwest rose 1.5°F between 1920 and 2000. Further statistical examination of monthly trends at the USHCN station at Ashton, ID showed that the increase in air temperatures was strongest during the winter and spring months, particularly in January and March.

Winter temperatures in January and March have been shown by other studies to be increasing significantly across the West (Hamlet and Lettenmaier 2007; Knowles et al. 2006). The increase, while small, has affected snowpack, stream temperatures, flooding and landslides, growing season lengths and disturbance regimes like wildfires, insect, and disease outbreaks (USGCRP 2009).

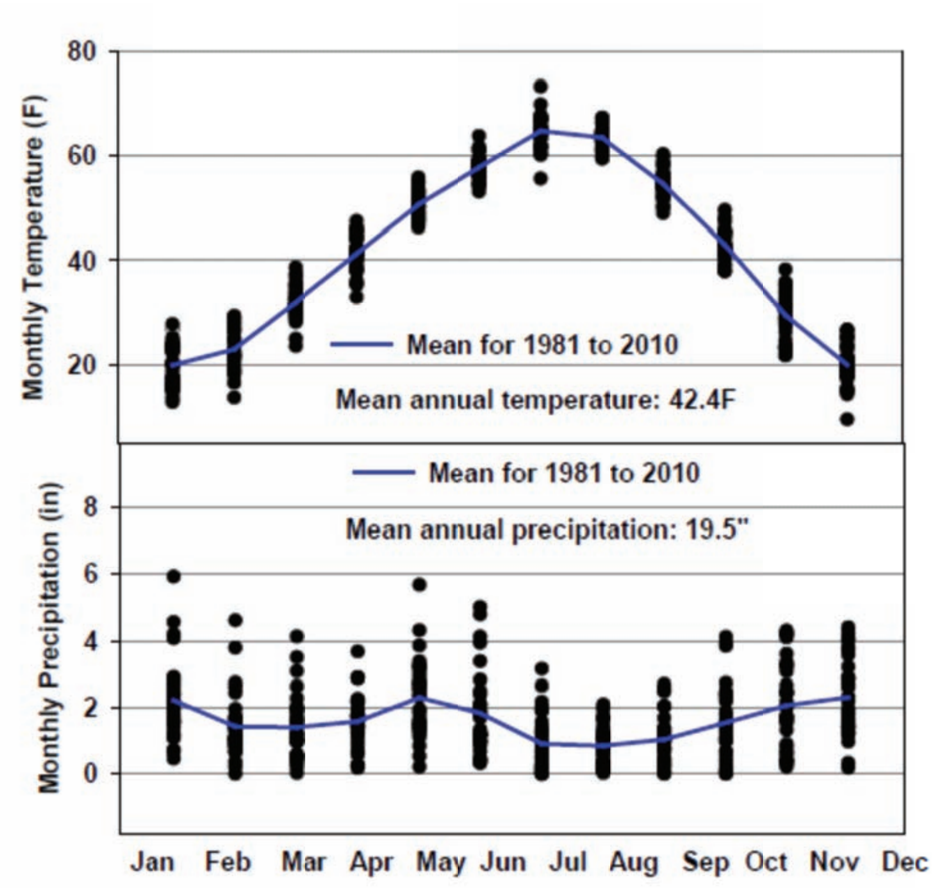

Figure 3.1. Mean and distribution of monthly temperature and precipitation at USHCN Ashton 1N, ID (100470) for the period 1981-2010.

From Camas NWR Water Resource Inventory Area [WRIA; USFWS 2011] Fig. 1.

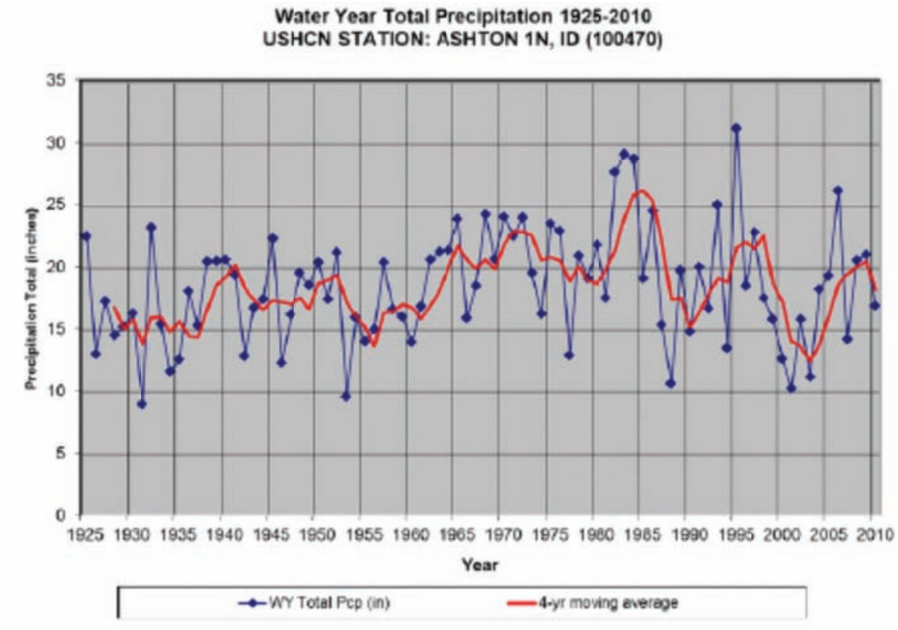

Figure 3.2. Trends in total precipitation at USHCN Ashton 1N, ID (100470) for the period 1981-2010.

From Camas NWR WRIA [USFWS 2011] Fig. 2.

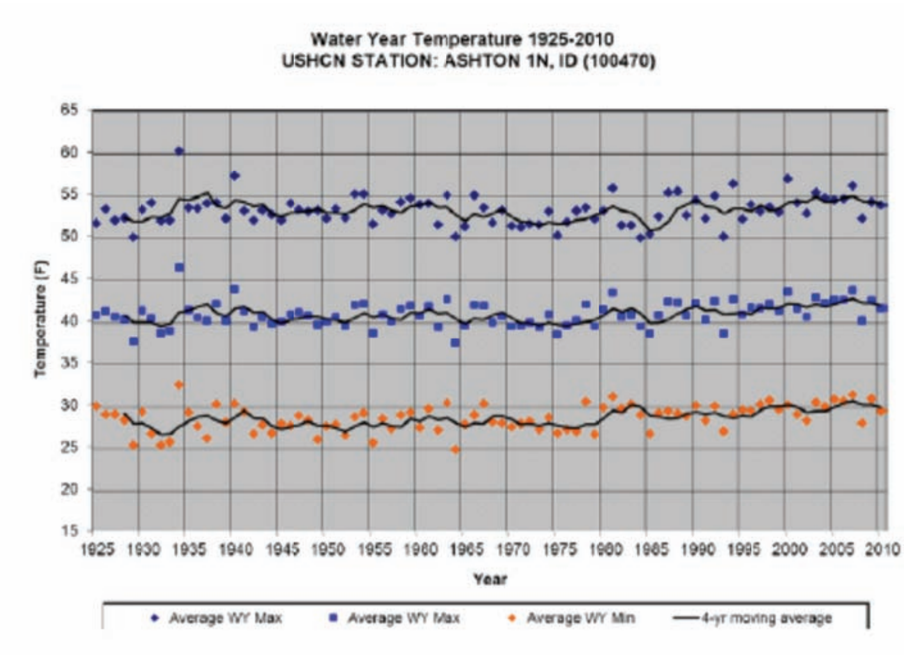

Figure 3.3. Trends in average temperature at USHCN Ashton 1N, ID (100470) for water years 1925-2010.

From Camas NWR WRIA [USFWS 2011] Fig. 3.

Streamflow Changes

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). As temperatures rise, the likelihood of winter precipitation falling as rain rather than snow increases. The loss of spring snowpack in the Pacific Northwest has been significant, with declines averaging 25 percent over the past 40 to 70 years (Mote et al. 2005). The declines are greatest at low elevation sites and have occurred in the absence of significant decreases in winter precipitation, implicating temperatures rather than precipitation as the cause of the trend.

The decrease in spring snowpack and earlier snowmelt has led to a change in streamflow in many systems, including earlier spring runoff peaks, increased winter streamflow, and reduced summer and fall streamflows. Stewart et al. (2005) examined 302 streamflow gages in the western U.S. and reported that the timing of winter runoff and annual streamflow had advanced by 1 to 4 weeks from 1948 to 2002. The degree of change depends on the location and elevation of the specific river basin. Basins located significantly above freezing levels have been much less affected by warmer temperatures than those located at lower elevations. Particularly relevant to Camas NWR are the timing changes reported for two Idaho streams. Both basins are presumably influenced by the same regional climate regimes. The snowmelt peak in the St. Joes River (basin elevation 2,172 feet), advanced 19 days from 1948 to 2002 while in the Big Lost River (basin elevation 6,821 feet), the peak only advanced 6 days for the same period. The Big Lost River is located just west of the Refuge (Stewart et al. 2005).

3.2.3 Potential Changes to the Refuge

There have been no specific studies documenting effects of climate change to the Refuge’s wildlife and habitat. There have already been major and irreversible changes to refuge habitats and wildlife due to changes altered streamflows (due to upstream diversions) and a lowered water table, introduced species, land conversion to agriculture, and surrounding land uses. The impacts of climate change will be difficult to distinguish from these other impacts, at least in the near term. Potential effects of climate change to the Refuge, and the interaction between climate change and other factors influence refuge habitat and wildlife, are examined in detail in Chapter 6.

3.3 Hydrology

3.3.1 Beaver-Camas Watershed

Camas NWR lies at the southern end of the Beaver-Camas Subbasin (eight-digit Hydrologic Unit Code), which originates on the south side of the Centennial Range north of the Refuge and terminates at Mud Lake, a natural playa which was dammed in the 1920s, forming a year-round impoundment. The Beaver-Camas watershed is the easternmost drainage in a system that shows no connectivity to the Snake River. Hydrologically, the Beaver-Camas Subbasin is a closed drainage or hydrologic sink, with no surface outflow. Mud Lake is located in the southern tip of the Beaver-Camas Subbasin, approximately 8 miles southwest of the Refuge, and it is the subbasin’s hydrologic endpoint. There are no natural surface flows from Mud Lake to any other body of water.

The drainage area of the Beaver-Camas watershed at the point where Camas Creek exits the Refuge is 643,083 acres (1,005 square mi). The basin elevation averages 6,030 feet, and ranges from 4,777 feet at the southern end of the basin to 9,872 feet at the northern end of the basin. There are two main drainages in the Beaver-Camas watershed: the Beaver Creek drainage and the Camas Creek drainage (Chapter 1, Map 1). Natural infiltration and diversion for irrigation limit the presence of water in the stream channel throughout the lower two-thirds of the subbasin. A significant quantity of surface water in the watershed is diverted for agricultural use.

3.3.2 Groundwater

Two of the most distinct hydrologic characteristics of the Beaver-Camas watershed are: (1) the massive natural infiltration of stream surface water and (2) the introduction of groundwater via wells into Camas Creek and ultimately Mud Lake.

Camas NWR is underlain by the Snake River Plain Aquifer, a vast groundwater aquifer that extends throughout the Snake River Plain from the western boundary of Yellowstone National Park in eastern Idaho to the Idaho-Oregon border where the Snake River enters Hells Canyon, an area of approximately 28,000 square km (10,811 mi). Camas NWR lies in the northeastern horn of the crescent shaped river plain. Surface water of the Camas-Beaver Watershed naturally infiltrates into the Snake River Plain Aquifer. Total groundwater storage in the upper 150 meters (492 feet) of the aquifer is estimated at 200 to 300 million acre-feet, roughly the equivalent of Lake Erie (DeGrey and Link 2011). Recharge in the ESRP aquifer is mainly from infiltration of streamflow and applied irrigation water, and groundwater inflow from adjoining mountains. The major contributing rivers are the Big Lost and Little Lost Rivers, Birch Creek, and Camas Creek, which drain the mountain ranges to the north and east of the Plain. Some recharge may be from direct infiltration of precipitation, however the hot, arid climate of the Plain make this a minimal contribution (Lindholm et al. 1987). Natural discharge from the aquifer principally occurs through springs along the Snake River at two areas about 100 miles downstream of Camas NWR: the American Falls Reservoir and Thousand Springs, west of Twin Falls.

Ackerman (1995) more precisely defines the system:

> “Most flow in the aquifer is contained within a regional-scale compartment and follows paths that discharge to the Snake River downstream from Milner Dam. Two intermediate-scale compartments exist along the southeast side of the aquifer and near Mud Lake. One intermediate-scale compartment along the southeast side of the aquifer discharges to the Snake River near American Falls Reservoir and covers an area of nearly 1,000 square miles. This compartment, which receives recharge from an area of intensive surface-water irrigation, is apparently fairly stable. The other intermediate-scale compartment near Mud Lake covers an area of 300 square miles.”

Human activity has had a tremendous impact on the water balance of the ESRP aquifer. About 60 percent of total recharge to the aquifer is derived from irrigation with surface water. Most groundwater still leaves the aquifer via springs and seepage losses in the two major upper basin reaches mentioned above, although pumping withdrawals contribute significantly to the aquifer's total losses. Irrigation practices have and continue to exert a major influence on water resources of the ESRP. During the first half of the 20th century, spring discharges increased at the two major discharge areas in the eastern portion of the aquifer and the water table in the central part of the aquifer rose by 60 to 70 feet on average due to irrigation on the Egin Bench, about 15 miles east of the Refuge (see Section 3.3.3 below). This was due to the common early practice of flood irrigation: farmlands were irrigated by releasing large amounts of water (either from reservoirs or canals) over agricultural fields. This was not a very efficient practice and most water infiltrated back into the aquifer system.

During the 1950s and 1960s more land was irrigated with groundwater and irrigation efficiency increased through the use of sprinkler irrigation. This resulted in a substantial decline in groundwater levels in parts of the Plain between 1975 and 1995, leading to a cumulative decrease in aquifer storage of about 3 percent, and decreased spring flows in the central part of the aquifer. In general, the declines in spring discharge and groundwater levels have been caused by increased groundwater pumping, more efficient irrigation methods, and reduced reliance on surface water diversions for irrigation. Localized declines may be predominantly the result of increased pumping withdrawals in some areas (De Grey and Link 2011).

Currently, there are approximately three million acres of irrigated farmland within the Snake River Plain with about one-third of this area irrigated with groundwater and the other two-thirds irrigated with surface water. The extensive irrigation system is the primary reason that Idaho has the highest per capita water consumption in the nation. The ESRP aquifer was designated a sole source aquifer in 1991. It provides the sole source of drinking water for nearly 200,000 people in southeast and south central Idaho.

There are 44 wells in the USGS Active Groundwater Level network in Jefferson County, Idaho. Statistics are calculated for each well in the network and compare the most recent groundwater-level measurement to the period of record. A groundwater level category is then determined from the most recent data measurement. Of the 44 wells in Jefferson County, 24 are ranked as either: Below Normal, Much Below Normal or Low Groundwater Level. The Below Normal Groundwater Level rank indicates that the most recent groundwater measurement is lower than the lowest monthly median groundwater level in the month of measurement for the period of record. The sites closest to the Refuge are all within the normal percentile class; however, many indicate declines in water level over the last 10 years.

Figure 3.4 shows groundwater levels for the period of record 1952 to 2011 for the continuous, real time USGS Site No. 434307112382601. Groundwater levels varied but were fairly stable during the early part of the record. Since the 1980s, levels have declined about 15 feet. This groundwater well is located about 20 miles southwest of the Refuge in an area that does not appear to be currently irrigated. The decline in water levels in this well likely reflects the general decline in water levels in the aquifer as a result of increased pumping, more efficient irrigation practices, and reduced infiltration. Monitoring well records in the Idaho Department of Water Resources (IDWR) database (IDWR 2011) show declines of a similar magnitude over the same time period (1980 to the present) in the area of the Refuge.

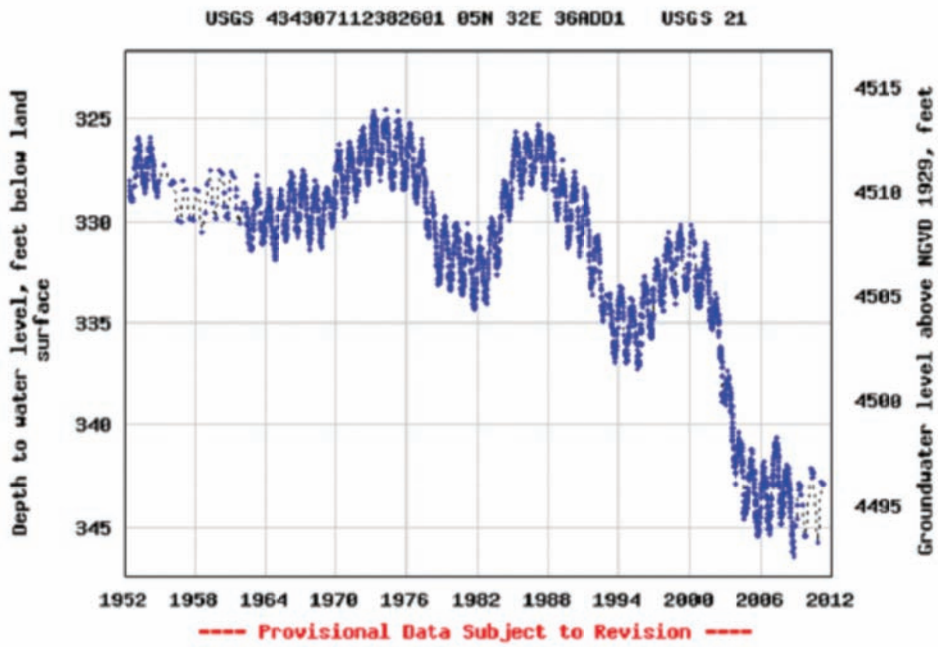

Figure 3.4. Groundwater levels for the period of record 1952 to 2011 at USGS Site No. 434307112382601.

3.3.3 Changes to Local Hydrology, 1900 to Present

Keigley (2012) provided a synthesis of the hydrologic history of the Refuge using General Land Office records, hydrology studies, legal proceedings, and local history. The discussion here is derived from this synthesis. Prior to the early 1900s, the area that is now Camas NWR did not have extensive permanent or semipermanent wetlands. Public land surveys in 1884 (east half) and 1899 (west half) show only a "slough" in the location of present-day Sandhole Lake, and a "Dry Lake" at the northeast end of present-day Rays Lake. These wetlands were fed by natural artesian wells, which discharged perched groundwater. Vegetation on the present-day Refuge was primarily sagebrush and bunchgrasses. The only stand of willows recorded on the present-day Refuge in 1884 was at "Dry Lake." This willow stand probably represented natural artesian flow in this area. (Although Camas Creek overtopped its banks each spring, this would have created seasonal to ephemeral wetlands, with saturated to temporary water regimes, rather than permanent or semipermanent wetlands.) The extensive wetlands mapped by Stearns in 1921 appear to have resulted from subirrigation of the Egin Bench area, 15 miles to the east, starting in the late 1800s. Other than the willows at Rays Lake, the oldest willow stands on the refuge area appear to date from about 1920 (Keigley 2012).

The construction of irrigation canals began soon after settlement, and irrigation was required for land acquired under the Desert Land Act of 1877, and the later Desert Land Act of 1894 (Carey Act). As the region's water table rose in the 1920s, plans were made to redistribute that abundant supply with canals, drains, and pumps. A portion of the water control infrastructure at Camas NWR was present when the Refuge was acquired. Additional infrastructure that is currently in place at Camas NWR was designed to ensure reliable water throughout the summer in drought years, but likely with the assumption of a high water table that would allow wetlands to hold water.

The Refuge was established after 12 years of subnormal precipitation starting in the 1920s, culminating in a severe one-year drought in 1934 (Pechanec et al. 1937). Like many refuges established in the 1930s, Camas NWR was established to protect and enhance dwindling wetlands for waterfowl production. After refuge establishment, impoundments and water control structures were created to provide reliable wetlands throughout the summer, and in drought years, to support breeding waterfowl and waterbirds. After the drought of the 1930s abated, reliable Camas Creek flows and a high water table allowed the Refuge to support a high density of wetlands, ponds, and wet meadows. New wetland projects were developed in the 1960s. It was at this time that the Refuge began using wells to fill wetlands. The high water table allowed wetlands to be filled with relatively low inputs of well water, and to remain filled throughout the brood rearing and migration season.

In the 1980s this situation began to change. Several factors led to a lowering of the water table in the Camas area. In the winter of 1979-1980, water to the canals on Egin Bench was cut off (a water rights issue). Up to this time, water had been maintained near the surface (20 feet) to facilitate irrigation in the spring (Young 1980). In 1980 the Mud Lake water master called Young (who was involved with water administration) describing the effect. Young believed that if it had not been for an exceptionally wet spring, the effect to Mud Lake Basin agriculture could have been devastating. The cessation of winter recharge had an immediate effect on the water table at Mud Lake. However, the cessation of winter recharge was moderated by the fact that the water table was seasonally raised to subirrigate crops on Egin Bench.

The second change began with the installation of pivot irrigation on Egin Bench. Pivots derive their water from canals and surface irrigate crops with far less water than that required for subirrigation. A 1987 photo of part of Egin Bench shows few pivot sprinklers. By 1996, “most” of the Egin Bench area was irrigated by pivot sprinkler (Sullivan et al. 1996). The combination of the cessation of winter recharge in 1980 and the switch to pivot irrigation ended the abundant supply of Egin Bench water that had been inputted into the Mud Lake Basin for decades—and the source of water that created the extensive deepwater wetlands of the 1910s and 1920s in the Camas area.

As the water table lowered, the Refuge had to pump increasing amounts of well water to fill certain wetland basins. To date about 25 percent of managed wetlands have been placed in “inactive” status due to their inability to hold water, which appears to be due to a combination of sandy soils and the lower water table. In addition, the northern Snake River Plain experienced a drought from 1987 to 1992 (Leonard et al. 2000) and the Upper Snake River Plain has been in an “extreme drought” for 12 years as of 2012 (−4.0 or less on the Palmer Drought Severity Index).

3.3.4 Streams

The three streams that flow through the Refuge are: Camas Creek, Beaver Creek, and Warm Creek. The major stream is Camas Creek, which flows through the entire Refuge before exiting and terminating west of the Refuge at Mud Lake. Beaver Creek is a small tributary of Camas Creek that enters the Refuge just before its confluence with Camas Creek. Warm Creek branches off of Camas Creek just upstream of the refuge boundary and flows onto the Refuge to terminate at Mallard Slough (Map 9).

Table 3.3. Named Creeks and Streams on Camas NWR*

Stream Name	Miles on Refuge
Beaver Creek	0.7
Camas Creek	11.9
Warm Creek	7.3
Total	***19.9***

*Includes features on or within 0.1 mile of the Camas NWR approved boundary.
Source: USGS 1:24,000 National Hydrography Dataset and digitized by USFWS staff.

Beaver Creek

The hydrology of the Beaver Creek drainage is principally spring runoff driven. Beaver Creek is a fairly substantial tributary to Camas Creek for the short period of time that it flows. The creek has its headwaters in the peaks of the Centennial Mountains to the north and east of Camas NWR. Water is sustained in Beaver Creek throughout the year above Spencer, ID. Beaver Creek flows in a canyon to a point some distance below Spencer, where it hits a lava gorge about 50 feet deep and commences to flow across coarse gravel soils, where much of the flow sinks into the ground (Stearns et al. 1939:45). Stearns et al. (1939) state: “During the spring flood period the creek usually flows for about two months all the way to its mouth and discharges into Camas Creek, but during the remainder of the year the creek is generally dry below a point about three miles south of Dubois.”

Typically Beaver Creek will begin to flow a few days to a week before Camas Creek, providing the first water through the Camas Creek channel and onto Camas NWR. The flow of Beaver Creek is much shorter lived on the Refuge than Camas Creek, and usually only provides two to four weeks of measurable flow. Today, Beaver Creek will remain dry far to the north of Dubois.

Camas Creek

The hydrologic characteristics of Camas Creek are even more complex and diverse than those of Beaver Creek. The upper eastern edge of the watershed (the southern slopes of the Centennial Range) is the source of flow to Camas Creek and, like Beaver Creek, flows are principally spring runoff and precipitation driven. A number of streams drain the mountains and form a spider web of drainages and ephemeral creeks that flow through an area referred to as the Camas Meadows, which extends from Kilgore to Eighteenmile. Some of the major tributaries are East and West Camas Creeks, Dry Creek, Ching Creek, Cottonwood Creek and Crooked Creek. Near Eighteenmile, below the wetlands, all of the streams converge to form what is considered the headwaters of Camas Creek. Here the basin narrows, forming a lava canyon. This canyon extends to a point a few miles above the Refuge’s northern boundary. Below the canyon the creek flows over sand and gravel, and eventually through Camas NWR (for approximately 8 miles) to Rays Lake, where lava crops out in some places. From Rays Lake the creek flows to Mud Lake over sand and clay where surface flow terminates (Stearns et al. 1939:44).

Camas Creek receives a very large volume of water from the upstream tributaries and flow is sustained in the upper reaches of the creek year round, to the point where land use changes from rangeland to irrigated agriculture and several major water diversion structures remove the surface water. The entire length of Camas Creek is a losing reach through the porous basalt streambed, meaning that streamflow is naturally lost from the stream channel to the groundwater system through infiltration. This is characteristic of many of the streams in this part of the State.

Below Camas, Camas Creek does receive an annual spring flush; however, continuous flows are not sustained in this reach. In the past, surface flows in the creek's lower reach were supported by a high groundwater table and assisted by artesian springs or flowing wells that dotted the landscape. The Refuge's Annual Narratives describe the refuge portion of Camas Creek as "intermittent" since 1937. But when Camas Creek was not flowing, in most years slack water would fill the channel.

The main channel of Camas Creek,where it enters the Refuge, is subject to estimated average flows of 160 to 180 cubic feet per second (cfs). Extreme events estimated at, or above, 200 cfs can occur. Monthly flows from the USGS gaging station (No. 1311200), 1 mile north of the Refuge, indicate that most of the flow in this reach occurs in April, May, and June (Figure 3.5).

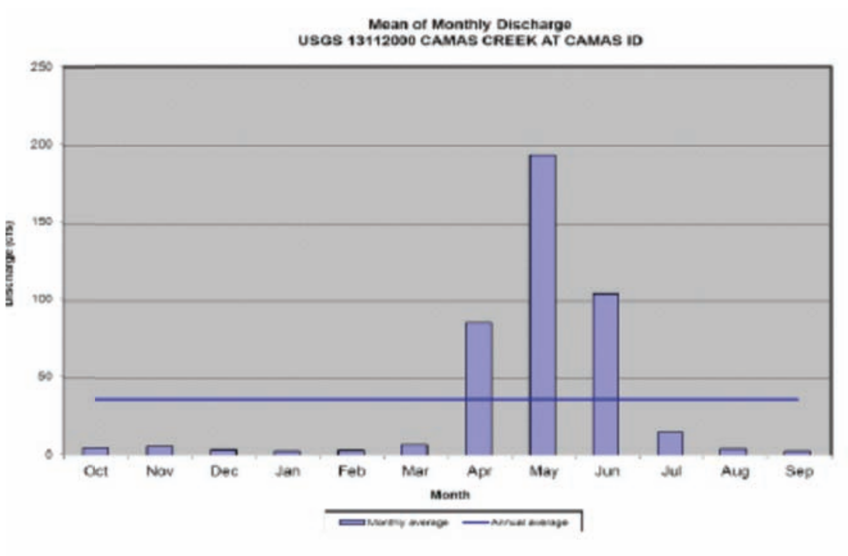

Figure 3.5. Average monthly streamflow at USGS Station No. 1311200, Camas Creek near Camas, ID.

From Camas NWR WRIA [USFWS 2011] Fig. 5.

Refuge annual narratives record highly variable dates for Camas Creek flow, and dates by which ponds were filled. Between 1941 and 2009, snowpack recorded ranged from less than 50 percent normal to over 250 percent normal. Camas Creek starts running between 1 January (years with year round flows) and 1 May, and ceases flowing between May 5 (1992, 2004) and December 31 (in years with year round flows). In the exceptionally wet years of 1982 through 1984 it flowed year round, while in the drought year of 2004 it flowed for only four weeks (Table 3.4). During the last decade, Camas Creek flows have typically started in March or April and ceased in June or July. Spring flows typically last about 2 months, but can persist for as long as 4 months and have been reported to be as short as 2 weeks. Time series data from the USGS gage show that while the total annual flow over the period of record has increased, the number of years with zero flow in August has remained equal or even increased (USFWS 2011). Refuge data (Table 3.4) indicate that "subbing" (ponds filling from subsurface flow) has been extremely variable, as well. Ponds filled within two weeks after first flows, to not at all.

Table 3.4. Camas Creek Flow Dates from Camas NWR, 1941-2009

Year	Camas Creek Flow Begins	Ponds Full	Camas Creek Stops Flowing
1941	03/18	04/30	
1942	04/01	05/01	
1943	03/26		
1944	04/03	05/15	
1945	03/13	04/30	
1946		04/30	
1947		04/01	
1948		07/12	
1949	04/09	04/24	
1950	04/02	04/15	
1951			
1952		05/01	
1953			
1954	04/01	04/21	
1955			
1956			
1957	03/15	05/15	
1958	04/01	04/30	
1959			
1960	03/15	04/01	
1961	04/08		
1962			
1963	04/04		
1964	04/19		
1965	04/15		
1966	04/15		
1967			09/03
1968	05/01		
1969	04/07		
1970			
1971			
1972			
1973			
1974			
1975			
1976			
1977			
1978			
1979	04/11		
1980	04/18		
1981	02/19		
1982	02/01		
1983	01/01		12/31
1984	01/01		11/01

Table 3.4. Camas Creek Flow Dates from Camas NWR, 1941-2009

Year	Camas Creek Flow Begins	Ponds Full	Camas Creek Stops Flowing
1985	01/01		07/18
1986	03/06		07/14
1987	04/10		06/01
1988			06/08
1989			06/29
1990			06/23
1991			06/16
1992			05/05
1993			07/12
1994	04/17		05/25
1995	03/12		08/15
1996	02/20		07/15
1997	01/08		08/31
1998	01/30		10/12
1999	01/01		12/20
2000	02/01		08/14
2001	04/03		06/24
2002	04/15		06/20
2003	04/14		07/05
2004	04/05		05/05
2005	04/18		07/15
2006	03/07		08/09
2007	03/09		06/21
2008	04/30		07/07
2009	04/15		07/22

Further downstream, just below the Refuge, groundwater is pumped into the dry Camas Creek channel to provide water for irrigation. The system of groundwater wells is known as the "Owsley Wells" and is responsible for providing the water that sustains Mud Lake.

Surface erosion from upstream agriculture and grazing has led to sediment transport and deposition within Camas Creek. Over the years, the sediment deposits have been removed from Camas Creek with the spoils placed adjacent to the channel, further confining natural channel flow and function. The spoils create levees prevent natural channel-floodplain interactions. Additionally, lowering of the channel elevation in Camas Creek hastens the drainage of Rays Lake to Camas Creek, reducing the Refuge's ability to retain water for habitat in the lake.

3.3.5 Canals and Drainage Ditches

An extensive system of canals, ditches and water control structures is used to move water from the points of diversion (either wells or surface water) to the places of use. Approximately 13.2 miles of canals and ditches are present and indicated on Map 9.

Two of the ditches on the Refuge are privately owned. The Independent Ditch flows through the Refuge and is operated by the Independent Water Users of Mud Lake, Inc. Water from the Independent Ditch eventually flows into the Camas Creek channel as it nears what is now the Mud Lake State Wildlife Area. Jacket Ditch starts at a well on private land, flows through the Refuge and eventually ties into Independent Ditch, supplying water for downstream irrigators. Jacket Ditch is managed by the Mud Lake Water Users, Inc. A summary of ditches on Camas Refuge can be found in Appendix A, Table 6 of the Water Resources Inventory and Assessment (USFWS 2011).

3.3.6 Lakes and Ponds

The existing complex of wetlands, ponds, and wet meadows is maintained through water management. Water is intensively managed on this Refuge through a series of dikes, canals, diversions, well pumps, and water control structures. Inflows, outflows, and water levels in most of the major wetlands and ponds on the Refuge are regulated. Inflows come from the surface water streams, groundwater wells, and direct precipitation and runoff, although with less than 10 inches of rainfall annually, precipitation inputs are limited. Evapotranspiration has not been measured on the Refuge but can be estimated to be about 3 feet per year, based on ET data and maps from IDWR. Map 9 (above) shows NWI wetlands, and flow to and from these wetlands via canals and natural water courses.

The total wetland area for the Refuge, from NWI, is estimated to be 6,324 acres, which constitutes 60 percent of the total Refuge. This includes the Refuge's meadow management units, which are temporarily flooded and contain a mixture of native wet meadow vegetation and non-native lowland vegetation (see Chapter 4).

The total surface area of all ponds (wetland basins) on the Refuge is 2,844 acres, which is approximately one quarter of the total area of Refuge (Table 3.5). These are all modified basins, where an effort was made to create a more permanent, that is deeper, marsh through structural means, including provision of additional water. Supplemental water is, or was supplied to these wetlands through three methods, either singly or in combination: well water through delivery ditches, Camas Creek water via delivery ditches, and Camas Creek flood flows. 595 acres of these modified wetlands (25 percent of total managed wetlands) have been placed in "inactive" status because there is no longer adequate water for hydration, the water delivery system is no longer functional, or both. Most have been dry for the majority of the past 30 years, but those that connect to Camas Creek may occasionally become hydrated due to early season stream overflow, or flooding. Table 3.5 below presents data on the Refuge's active and inactive modified wetland basins.

Due to decline of the local aquifer, and degradation of streamflows before and since refuge establishment, both the number and total acreage of refuge wetlands that can reliably be hydrated in any given year has precipitously dropped over the past 30 years. Therefore the Refuge prioritizes "core" wetland units for management. These wetlands exhibit a combination of high wildlife values and the ability to deliver adequate water to most of them on a yearly basis. Water sources for the core wetlands include both Camas Creek and well water via irrigation ditches. Currently, the following Camas NWR wetlands are considered "core wetlands:" Big Pond, Redhead Pond, Center Pond, Two-Way, and Toomey. Due to the infrastructure of the Camas NWR water delivery (ditch) system for both surface and subsurface water to ponds, water has to cross at least one other pond before arriving at the target wetland; this reduces management flexibility in terms of being able to either dewater some ponds in the upstream portion of the delivery system, or to efficiently deliver water to ponds on the downstream end of the system. During periods of water shortage, the core wetlands (677 acres total) may be the only basins to receive any substantial amount of water. Ray's Lake, which receives water from Camas Creek, is typically drawn down every year for irrigation by downstream water rights holders. However in very wet years it may fill enough to backflow into Cattail Flat, Sandhole Lake, and Mallard Slough. Cattail Flat and Mallard Slough dry out by summer in most years. Sandhole Lake is unconnected to the main water delivery system. It rarely goes dry, and is the only refuge wetland that can subsist entirely on its own water supply in most years.

Map 9. Camas NWR - Flow Map

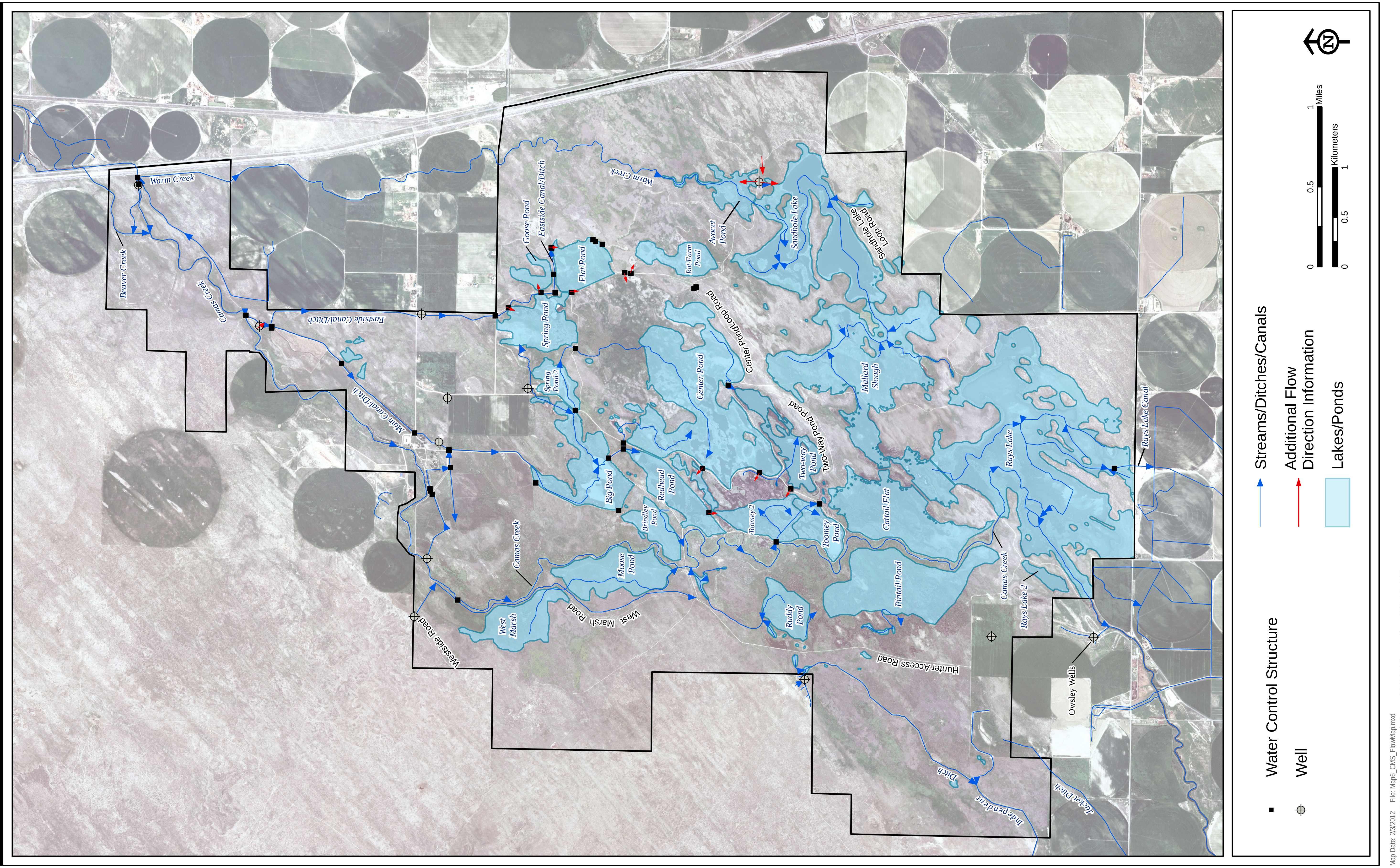

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Table 3.5 Acreage of Lakes, Ponds, and Impoundments in the Camas National Wildlife Refuge

Name	Acres	Water Source
Hydrated (Active) wetlands		
Avocet Pond	40.91	
Big Pond (Core wetland)	113.59	Camas Creek and well water via ditches
Brindley Pond	39.49	Camas Creek and well water via ditches
Cattail Flat	167.22	Sandhole Lake; in wet years, reverse flow from Ray's Lake.
Center Pond (Core wetland)	329.00	Camas Creek and well water (Wells 4,5,6) via ditches
Mallard Slough	335.59	Spring runoff, well water pumped through Sandhole Lake, runoff from Sandhole Lake in wet years
Ray's Lake	615.40 13.26 (part)	Camas Creek
Redhead Pond (Core wetland)	67.96	Camas Creek and well water via ditches
Sandhole Lake	254.04	Spring runoff from adjacent uplands and groundwater influx. In wet years, reverse flow from Ray's Lake.
Spring Pond	75.13 31.08 (part)	Camas Creek and well water (Well 8) via ditches
Toomey Pond (Core wetland)	43.18 59.60 (part)	Camas Creek and well water via ditches
Two-Way Pond (Core wetland)	63.74	Camas Creek water via ditches
Total Active Modified Wetlands	**2,249.19**	
Inactive modified wetlands		
Flat Pond	59.13	Camas Creek and well water via ditches
Goose Pond	17.64	Camas Creek and well water via ditches
Moose Pond	98.62	Camas Creek and well water via ditches; overflow from Camas Creek
Pintail Pond	192.28	Camas Creek and well water via ditches; overflow from Camas Creek
Rat Farm Pond	42.76	Camas Creek and well water via ditches
Ruddy Pond	46.68	Camas Creek and well water via ditches; overflow from Camas Creek
West Marsh	77.14	Camas Creek and well water via ditches
Unnamed lakes/ponds (Incl NW#1,2)	61.00	Overflow from Camas Creek during flood stage
Total Inactive Modified Wetlands	**595.42**	
Total Modified Wetlands	**2,844.61**	

Note: Named ponds were derived from USGS National Elevation Dataset (NED) by refuge staff.
Unnamed ponds are from the USGS 1:24,000 National Hydrography Dataset.
Source: Adapted from Camas WRIA, USFWS 2011.

3.3.7 Water Rights

Idaho Water Law/Water Rights

A water right is required in the State of Idaho to divert, store, pump or generally use water. Water use must be measured and recorded in order to maintain the water right. Idaho water law, like many western states, is based on the doctrine of prior appropriation, or "first in time - first in right." The Idaho Water Code explicitly states that all waters of Idaho are public property, and a water right is a usufructuary right. Beneficial use is the measure and limit of a water right in Idaho. The State recognizes fish propagation, wildlife, and water quality control as beneficial uses. A diversion is generally required to establish a water right in Idaho. The Idaho Water Resources Board is the only entity authorized to appropriate rights for minimum instream flows, without diversions. In general, surface water rights on the Snake River and tributaries were developed before water rights for irrigation wells. Consequently, groundwater pumping rights for irrigation are typically junior to surface water rights. Idaho's conjunctive management rules hold junior groundwater users (excluding domestic use) partially responsible for spring and river depletion that potentially results in injury to senior surface water right holders.

In general, stream adjudication is a legal proceeding to inventory the water rights of an entire stream system by deciding their nature, extent and priority. Adjudications in Idaho involve both surface water and groundwater. The Snake River Basin Adjudication is an ongoing, general stream adjudication that began in 1987. It is one of the largest general adjudications in the country. Geographically, it involves 38 of the 44 counties in Idaho and accounts for about 87 percent of the State's water rights.

The Snake River Basin Adjudication will eventually determine the quantity, priority date and source of every water right in the Snake River Basin in Idaho. The Service has filed a number of water right claims and has been actively participating in this adjudication. In July 2002 the Snake River Basin Adjudication court issued partial decrees for both groundwater and surface water rights in Water District 31, which includes the Camas Refuge. The partial decree is one step forward toward a final decision in the adjudication process. In February 2007, the director of the IDWR filed its final report with the Snake River Basin Adjudication (SRBA) District Court. The director's report contains a preliminary determination for the majority of remaining water rights in the Snake River Basin.

A final decree will be issued once all the decrees in the Snake River Adjudication have been issued. The final decree will confirm and define each water right in the basin.

Camas Refuge Water Rights

Table 3.6a below, from the Camas NWR Water Resources Inventory and Assessment (USFWS 2011) contains a summary of certificated water rights on the Refuge. These include decreed rights (Camas Creek), groundwater rights, and appropriative rights (Camas Creek). The Water Management Plan for Camas NWR (Deutscher 2003) contains additional details about period of use, rate of diversion and diversion period for Camas NWR water rights. Map 10 (page 3-35) depicts current Camas water rights.

Table 3.6a. Certificated Water Rights held by Camas NWR

FWS Number	Certificate Number	Type of Use	Priority Date	Water Source
1	31-00269	Wildlife	4/1/1883	Camas Creek
2	31-00270	Wildlife	4/1/1884	Camas Creek
3	31-00271	Wildlife	4/1/1885	Camas Creek
4	31-00272	Wildlife	4/1/1886	Camas Creek
5	31-00273	Wildlife	4/1/1895	Camas Creek
6	31-00274	Wildlife	4/1/1883	Camas Creek
7	31-00275	Wildlife	4/1/1887	Camas Creek
8	31-00276	Wildlife	4/1/1883	Camas Creek
9	31-00277	Wildlife	4/1/1884	Camas Creek
10	31-00278	Wildlife	4/1/1885	Camas Creek
11	31-00279	Wildlife	4/1/1887	Camas Creek
12	31-00280	Wildlife	4/1/1895	Camas Creek
13	31-00281	Wildlife	7/30/1903	Camas Creek
14	31-00282	Wildlife	8/25/1902	Camas Creek
15	31-00283	Wildlife	3/23/1909	Camas Creek
16	31-00284	Wildlife	5/26/1911	Camas Creek
17	31-00231	Wildlife	4/1/1916	Unnamed Slough/Springs and Seeps
19	31-02251	Irrigation	11/4/1931	Groundwater
20	31-02322	Wildlife	5/9/1953	Groundwater
21	31-02350	Wildlife	10/20/1955	Groundwater
22	31-02362	Wildlife	5/13/1957	Groundwater
23	31-02363	Wildlife	5/13/1957	Groundwater
24	1-04016	Irrigation	6/15/1955	Groundwater
25	31-04066	Domestic	11/12/1936	Groundwater
25	31-04066	Irrigation	11/12/1936	Groundwater
26	31-07301	Wildlife	6/2/1978	Groundwater
975	31-11229	Wildlife	11/5/1957	Groundwater
1026	31-11230	Wildlife	3/20/1962	Groundwater
1027	31-11232	Wildlife	5/7/1962	Groundwater
1028	31-11231	Wildlife	5/7/1962	Groundwater
1029	31-11668	Wildlife	3/30/1941	Camas Creek
1030	31-11233	Domestic	1/1/1931	Groundwater
1031	31-11234	Domestic	1/1/1920	Groundwater
1031	31-11234	Livestock	1/1/1920	Groundwater

Table 3.6b. Privately Held Water Rights Located on Inholdings Within the Camas NWR

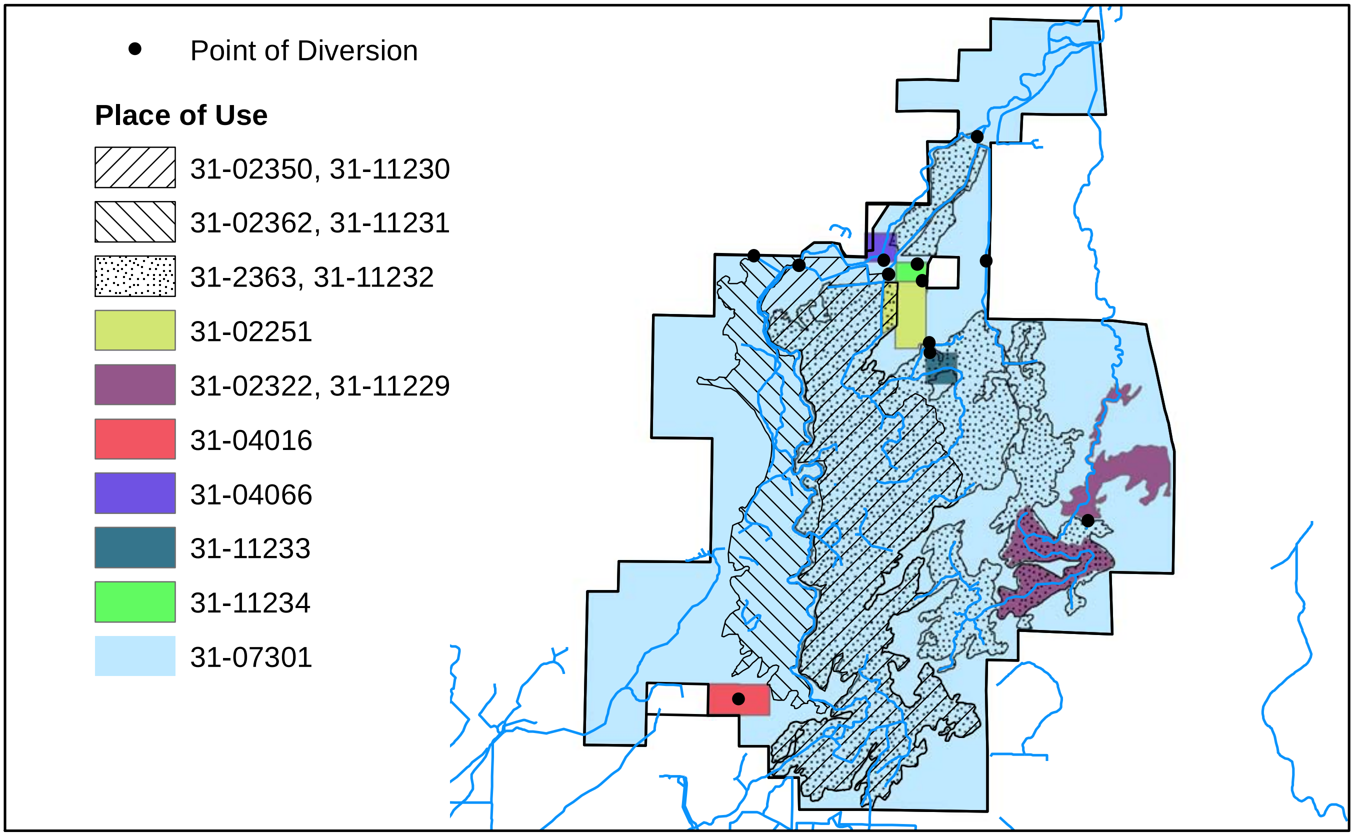
Status of Right	Certificate Number	Type of Use	Priority Date	Water Source
1172 Certificate	31-10373	Domestic	1/1/1948	Groundwater
1172 Certificate	31-10373	Livestock	1/1/1948	Groundwater
1173 Certificate	31-12074	Irrigation	1/21/1981	Groundwater
1174 Certificate	31-12075	Irrigation	1/21/1981	Groundwater
1175 Certificate	31-11328	Domestic	5/1/1965	Groundwater

Table 3.6c. Privately Held Water Rights with a POD Inside the Acquired Boundary at Rays Lake, and a POU Outside of the Approved Boundary for Camas NWR

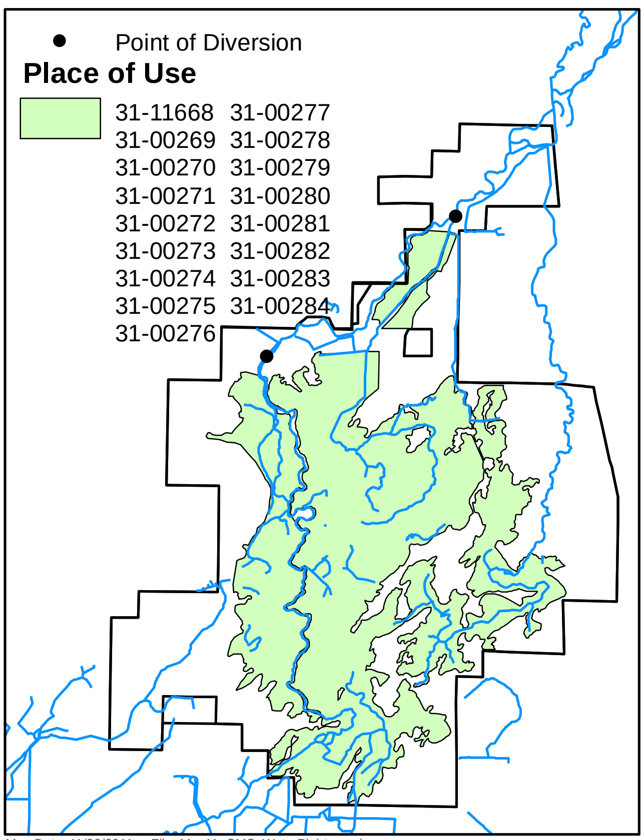
Status of Right	Certificate Number	Type of Use	Priority Date	Water Source
1169 Certificate	31-10499	Irrigation	9/5/1912	Rays Lake
1170 Certificate	31-00262	Irrigation	1/27/1914	Rays Lake
1171 Certificate	31-00267	Irrigation	8/10/1917	Rays Lake

Map 10. Camas NWR - Water Rights

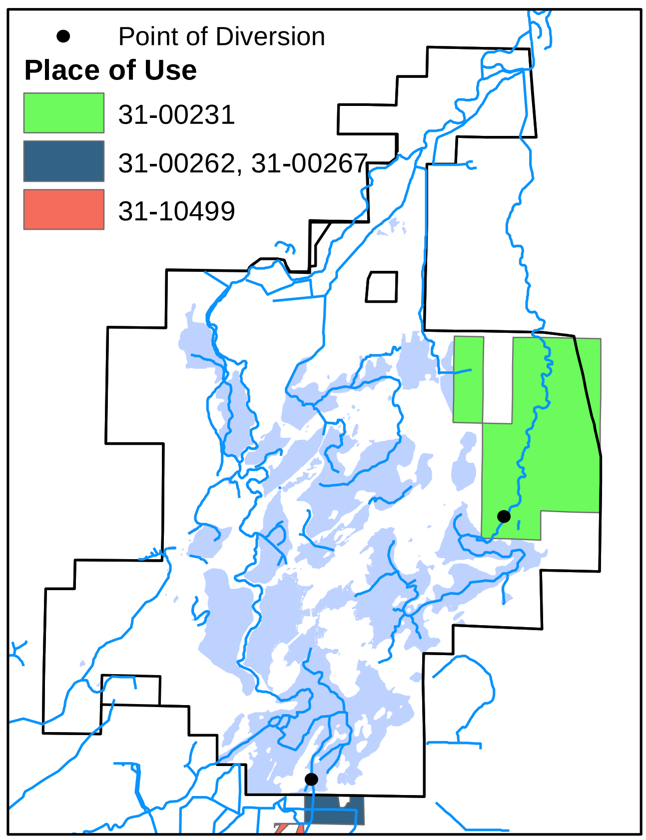
Ground Water Rights



Decreed Rights (Camas Creek)



Appropriative Rights (Camas Creek)



Map Date: 11/08/2011 File: Map11_CMS_WaterRights.mxd
Data Source: USGS 1:24,000 National Hydrography Dataset, USFWS Water Rights Database, Idaho Department of Water Resources Water Rights GIS.

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3.4 Topography and Bathymetry

Camas NWR lies within Jefferson County, ID, which is noted as one of the most uniformly level counties in Idaho (Jorgensen 1979). The Refuge sits at an elevation of 4,800 feet above mean sea level, with a low point of 4,784 feet being found in Rays Lake. Conversely the high spot is 4,850 feet, just west of the refuge boundary. This gently rolling topography historically provided islands of sage brush habitat intermixed with wetland meadows. Much of the Camas region consists of low, southwest-northeast-trending ridges and depressions (lineaments) created by windblown sand and silt, that are visible on aerial and landsat imagery (see sections 3.5 and 3.6 below).

3.5 Geology and Geomorphology

3.5.1 Physical Setting

Camas NWR lies on the northern end of the ESRP, the easternmost extension of the Columbia Intermontane Physiographic Province. The ESRP is an east-northeast-trending, 600-km-long (373-mi-long), 100-km-wide (62-mi-wide) topographic depression extending from Twin Falls to Ashton, Idaho (Hughes et al. 1999). The northern margin of the ESRP is bounded by the Beaverhead, Centennial, and Henry’s Lake mountain ranges of the Northern Rocky Mountain Physiographic Province. On the eastern and southeastern margin of the ESRP lie the Teton, Caribou, and Snake River ranges of the Middle Rocky Mountain Physiographic Province. On the west and northwestern margin lie the Pioneer, Big Lost, and Lemhi ranges of the Basin and Range Physiographic Province (BLM 2009).

Topography and drainage in the ESRP reflect interactions of a mantle plume (an upwelling of abnormally hot rock) with the crust of the North American tectonic plate. Beginning about 16 million years ago (Ma) and continuing to the present, the plate has moved progressively over the plume, causing uplift and rhyolitic caldera eruptions followed by subsidence and basaltic volcanism. As a result, the ESRP slopes to the southwest, away from the present location of the plume beneath the Yellowstone Plateau. The ESRP is divided into north and south segments by a cluster of large shield volcanoes, lava flows and rhyolitic domes. This topographic feature is called the axial volcanic high (Phillips 2012).

3.5.2 Geology and Geomorphology

The mountain ranges of the Northern and Middle Rocky Mountain Physiographic Provinces are part of the zone of structurally disturbed strata that form a mountain system that extends from northern Alaska to Central America. The mountains along the eastern and northern edge of the ESRP include metamorphic and sedimentary rock sequences that range in age from Precambrian to Mesozoic and have been uplifted, faulted, and folded. The mountains of the Basin and Range Physiographic Province are typical of the north-south-trending ranges that resulted from the stretching and thinning of the Earth’s crust in the western U.S. These ranges consist of Tertiary lava flows and interbedded pyroclastic rocks as well as Paleozoic sedimentary rocks, which have also been faulted and folded, and in some areas, hydrothermally altered (BLM 2009).

The volcanic rocks of the ESRP consist of a sequence of rhyolite flows capped by undissected Quaternary basalt flows that have a thickness of 5,000 to 6,000 feet. Quaternary deposits that cover the basalts consist of stream terrace and channel deposits as well as flood plain deposits and windblown sediments (BLM 2009).

Basaltic shields on the ESRP topographically control the deposition of younger sediments and lavas (Hughes et al. 1999). Modern sediments are distributed on the ESRP largely in eolian (wind-driven), lacustrine (playa-like sinks) and fluvial (river) depositional systems (e.g., Geslin et al. 1999; Gianniny et al. 1997; Hackett and Smith 1992; Kuntz et al. 1992, 1994). Playa sediments are clay-rich silt and fines and mixtures of eolian and stream-borne material. Fluvial sediments are mostly coarser sand, pebbles and cobbles. North of the axial volcanic zone that runs through the middle of the ESRP, they are derived from the Big Lost River, Little Lost River, and Birch Creek drainages with outlets on the Idaho National Laboratory (INL). Loess and eolian sand also covers most pre-Holocene surfaces and occurs as layers between lava flow groups in the subsurface (BLM 2009).

Rocks of Mesozoic and Paleozoic age crop out in the mountains adjacent to the Mud Lake plain. Limestone, shale, sandstone, and conglomerate of Carboniferous and Cretaceous age are present in the Beaverhead and Centennial Mountains. These ancient rocks are highly cemented and deformed and thus nearly impermeable (Idaho Dept. of Reclamation 1969).

Rhyolite and associated volcanic rocks of late Tertiary age outcrop along the mountain front to the north and east of the Mud Lake plain. These rocks are generally light colored, fragmental rhyolite and welded ash flows. Basalt overlies the rhyolite at several locations. The total thickness of the Tertiary volcanic rocks is unknown but probably exceeds 2,000 feet. Sedimentary rocks of possibly Pliocene age overlie the older Tertiary volcanic rocks along the mountain front. These deposits have an exposed thickness of approximately 500 feet and represent ancient alluvial fans (Idaho Dept. of Reclamation 1969).

The Mud Lake plain is underlain by large volumes of Quaternary volcanic rocks. These rocks are predominantly basalt with a few flows of andesite. The sources of these rocks were innumerable volcanic cones and fissures. Remnants of some of these vents now form small hills on the plain. Differences in erosion of various craters and numerous sedimentary interbeds indicate that the eruptions took place intermittently over a long period of time. The basalts, extruded as thin, low viscosity flows, are highly jointed and have cavernous, slaggy contacts. These features, in combination with lava tubes and blisters, provide openings for groundwater flow beneath the Mud Lake plain. Groundwater moves almost unimpeded through these rocks, and yields to wells of 4,500 gpm (gallons per minute) with little drawdown were common in the 1960s (Idaho Dept. of Reclamation 1969).

Recent lakebed deposits of sand, clay, and silt are present near Mud Lake. These sediments were deposited in a shallow lake formed during the Ice Ages, when ancient creeks to the north discharged into a structural depression. This lake, Lake Terreton, covered approximately 140 square miles in its highest stage. Numerous angular lava boulders, present in the lake sediments, were presumably rafted from shore by ice during the winter months. The lake sediments, which interfinger with the younger basalt flows, act more as confining beds than aquifers. The relatively high water table in the Mud Lake area is a result of the low permeability of these sediments. Extensive deltas were formed where creeks flowed into ancient Lake Terreton. These deposits, consisting primarily of sand and gravel, are located along the northern edge of the lake beds.

Alluvium of both Pleistocene and Holocene age is present along the major stream valleys and along the hill front as broad coalescing fans. These fans generally consist of detritus from older sedimentary rocks washed down from the mountains.

3.5.3 Geologic History

Several major late Tertiary geologic events are important to the formation of the ESRP. These include: (1) time-transgressive Miocene-Pliocene rhyolitic volcanism associated with the track of the Yellowstone hotspot, (2) Miocene to Recent crustal extension which produced the Basin-and-Range province, (3) Quaternary outpourings of basaltic lavas and construction of coalescent shield volcanoes, and (4) Quaternary glaciation and associated eolian, fluvial, and lacustrine sedimentation and catastrophic flooding (Hughes et al. 1999).

Yellowstone Hotspot

The most widely accepted hypothesis is that the ESRP was formed above a hotspot track created by the passage of the North American plate southwestward over a stationary mantle plume (Hughes et al. 1999). Along this track, a series of explosive, rhyolitic caldera eruptions occurred in Miocene and Pliocene times and represent some of the largest eruptions known. Rhyolitic volcanism associated with this postulated thermal plume began about 16.1 million years ago at the McDermitt volcanic field in northern Nevada and southeastern Oregon, progressed northeastward forming the ESRP, and arrived at the present position of the Yellowstone Plateau about 2 million years ago (Pierce and Morgan 1992). The Heise volcanic field, the second youngest of these fields, became active about 6.6 million years ago. A series of four large-volume eruptions occurred in this field over approximately 2 million years (Morgan and McIntosh 2005). Camas National Wildlife Refuge is located on the margin of the Heise volcanic field.

As a result of these caldera eruptions, rhyolite is far more abundant than basalt in the ESRP. Here, only a relatively thin veneer of basalt lies over a thick sequence of rhyolitic ash and flow tuffs (Digital Atlas of Idaho 2012). However, the source calderas for the rhyolite are buried below the basalts, and exposures of these rhyolites tend to occur at the margins of the ESRP (Morgan and McIntosh 2005). These basaltic and rhyolitic lava flows have been measured by drilling to a depth of 2.5 miles. One-half mile of basalt rests on more than two miles of rhyolite.

Basalt Flows

Overlying these Miocene-Pliocene rhyolites are much more recent basalts. Widespread basaltic volcanic activity occurred intermittently throughout the ESRP throughout Pleistocene and Holocene times. Basalts erupted from volcanic vents, as well as eruptive and non-eruptive fissure systems visible in and around some Holocene lava fields. These fissures occur mainly along the series of northwest-southeast-trending volcanic rift zones that occur on the ESRP. These eruptions were relatively small and short lived. Kuntz et al. (1992) estimate a meager magma output rate of 3.3 cubic km (0.79 cubic mi) per 1,000 years for the entire ESRP during the past 15,000 years. Most individual basalt flows in the upper part of the volcanic section are relatively thin, ranging from about 5 to 25 meters (16.4 to 82 feet).

The rift zones lie roughly parallel to Pioneer, Lost River, Lemhi, and Beaverhead ranges to the north, and may be extensions of northwest-trending, range-front faults of the Basin and Range Province. The Circular Butte-Kettle Buttes rift zone lies 12 miles southwest of the Refuge. The Lava-Ridge-

Hell's Half Acre rift zone, a few miles to the west, created the Hell's Half Acre lava field between Blackfoot and Idaho Falls. Craters of the Moon, which lies approximately 60 miles to the southeast of the Refuge, is the largest and most complex of the late Pleistocene and Holocene ESRP basaltic lava fields. Here, lavas erupted from the Great Rift, which extends about 5 miles across the Snake River Plain, covering about 1,600 square km (618 square mi) with about 30 cubic km (7.2 cubic mi) of basaltic and compositionally evolved lava flows. Eight eruptive periods occurred from 15,000 to 2,100 years ago with quiescent intervals as long as 3,000 years (Kuntz et al. 1992).

Standing out from this relatively flat basaltic plain are middle Pleistocene (300,000 to 1 million years old) rhyolite domes such as Big Southern Butte, 45 miles southwest of the Refuge, Middle Butte, and East Butte, About 300,000 years ago, the butte intruded through surrounding layers of basalt, rising to an elevation of 7,560 feet (2,300 meters). Other rhyolite domes include Middle Butte (less than 1,000 ka) and East Butte (600 ka), which lie to the southwest of the Refuge. Rising more than 2,500 feet (760 meters) from the plain, and with a base diameter of 6.5 kilometers (4.0 mi) and a combined volume of approximately 8 cubic kilometers (1.9 cu mi) (Haller and Wood 2004), Big Southern Butte is the largest rhyolite dome on the ESRP and one of the largest composite rhyolite domes in the world (INL 2012b).

Tuff rings (tuff is a fine grained rock composed of volcanic ash) are uncommon on the ESRP and represent phreatic eruptions (eruptions into saturated ground beneath transient lakes or other regions with elevated water tables). For example, phreatic eruptions near Mud Lake produced mixed volcaniclastic deposits of sand, ash and juvenile scoria containing numerous accidental blocks of lacustrine sediment and older basalt.

Recent Geologic History

During the Pleistocene, a large ice sheet formed several times on the Yellowstone Plateau. Two periods of glaciation have been recognized and dated at Yellowstone: the Pinedale glaciation between 14,000 and 25,000 years ago (14-25 ka); and the Bull Lake glaciation between about 140 and 150 ka. Small alpine glaciers also formed on the higher mountains northwest of the plain during these glaciations. During glacial periods the Snake River was the principal meltwater channel of the Yellowstone ice sheet. The river was transformed from a narrow, largely single-channel meandering stream into a huge braided stream with a floodplain 10 to 30 km wide (6.2-18.6 mi) (Phillips 2012).

A shallow series of freshwater lakes, of which Lake Terreton was the largest, formed in areas of internal drainage during glacial periods. These lakes filled with fine-grained sediments that were reworked into eolian deposits when the lakes dried up. Throughout the region, alluvial fan sedimentation increased during these times, also bringing fine-grained sediment onto the plain (Phillips 2012). Lake Terreton dominated the northern reaches of the Pioneer Basin throughout most of the Pleistocene epoch (about 1.8 million to 10,000 years before present). The lake covered 140 square miles at its highest stage at the end of the Pleistocene, about 13,000 years ago. During this time the region was cooler and wetter than it is today and local rivers had higher and more reliable flows. Camas and Beaver Creeks sustained an eastern subbasin of Lake Terreton, known today as Mud Lake. About 20 miles to the west, on lands now within the boundaries of the INL, Birch Creek and the Big and Little Lost Rivers fed a western subbasin of the Lake that was approximately 90 square miles in extent (Braun et al. 2007; Gianniny et al. 2002). Over its long lifetime, Lake Terreton expanded and receded in response to wet and dry climate cycles during the Pleistocene. As a result, sediments deposited in the lakebed alternated between clay-rich lacustrine sediments and sandy fluvial and eolian (wind deposited) sediments (Geslin et al. 1999). When the climate became warmer and drier about 10,000 years ago, much of the lake dried up. Mud Lake is the modern remnant of Lake Terreton (INL 2012a).

During the Pleistocene, extensive eolian deposition produced thick loess blankets on the ESRP and in adjacent areas of southeastern Idaho (Pierce et al. 1982). Although the ESRP was never glaciated, large amounts of sand and silt were brought onto the Plain by meltwaters from glaciers in surrounding highlands. These deposits were reworked and transported by the strong winds characteristic of glacial periods (Phillips 2012).

Loess is widespread across the ESRP, reflecting multiple sources of fine-grained sediment. South of the axial volcanic high, the major source was outwash deposits along the Snake River. North of the axial volcanic high, including the Camas NWR area, alluvial fans and outwash from drainages with alpine glaciers were likely the most important loess sources. During Pleistocene glaciations, the Snake River probably operated like modern high latitude rivers with high discharge and flooding during spring-early summer meltout, and low discharge during winters when the glacial outwash system was largely frozen. Silt and clay on vegetation-free braid plains were exposed during winter to strong drying winds, which picked up and transported the deposits as loess. Loess accumulation diminished greatly at about 14 ka with retreat of the Yellowstone ice sheet and reduction of outwash stream and alluvial fan discharge. The Snake River became incised at Idaho Falls between 14.4 to 12.6 ka, probably as a result of diminishing discharge. Stream incision greatly reduced the area of vegetation-free outwash deposits subject to deflation of fine sediments. Loess covers all Pleistocene lava flow surfaces but is thin on 17.4 ka Bonneville Flood deposits and almost absent on a 6 ka lava flow (Phillips 2012).

Sand Dunes

Sand dunes are widespread over most of the ESRP. Transport of sand to form dunes largely occurred after cessation of loess deposition and continues to the present day. The largest dunes are in the northern end of the plain near St. Anthony. Bonneville Flood deposits form the sand source for the dune field that extends over 110 km (68 mi) from near American Falls to near Idaho Falls. Dating of ESRP dunes with the optically stimulated luminescence (OSL) technique yields mostly Holocene ages, suggesting that regional droughts controlled periods of dune destabilization and movement (Phillips 2012). Today, severe dust and sand storms occur several times a year in the ESRP. These events occur at areas recently burned by wildfires and over plowed fields.

Current Eolian Processes

Eolian (wind-driven) processes, aided by range fires that denude large tracts of the ESRP, have continued to modify the landscape up to the present time. Numerous historic and prehistoric fire scars on the ESRP suggest a continuing process of eolian redistribution of loess following range fires. Prominent linear features (lineaments) on the ESRP, observed in landsat imagery and aerial photography, are the result of the redistribution of surface materials by wind following range fires (Morin-Jansen 1987 in Hughes et al. 1999). These lineaments are repeatedly formed and destroyed by range fires and wind. Range fires tend to have the same shapes and sizes in various parts of the plain, reflecting similar prevailing wind directions and fire dynamics. Over the long term, sediment is continually on the move in a down-wind direction (northeast). A sorting of the upper few centimeters to decimeters of soil may occur, with fine material being moved farther downwind and coarser material lagging behind (Hughes et al. 1999). Such lineaments are clearly visible on BLM lands to the west of the Refuge, and are reflected in the Refuge's soil types and vegetation as well (see Section 3.6, Soils).

This process has been observed in action since the mid-1990s (Hughes et al. 1999). Range fires on and near the INL have provided real-time observations of wind-driven sediment redistribution on the ESRP. Since early 1994, nine range fires burned over 60,000 acres (95 square miles) of sage-steppe and grasslands. Ensuing dust storms whipped up by prevailing winds caused highway closures and shutdowns of work at some INL facilities. Measurements of soil erosion and estimates of removed material indicate that millions to tens of millions of cubic meters of fine-grained sediments had been mobilized. Under these conditions, very rapid development of new landforms and modification of existing landforms may occur. For example, within a few days of a 17,000-acre fire in the western part of the INL in 1994, a discontinuous dune, 20 km long (12.4 mi long), 1 meter (3.3 feet) high, and several meters wide, formed along the eastern (downwind) edge of the fire scar. A 2-meter-wide (6.6-feet-wide) fissure along the east edge of the scar was filled with sediment after the first wind storm. In the eastern INL a 19,000-acre fire in 1996 burned an area that contained a prominent lineament, called the Principal Lineament, which was itself formed by eolian modification of a prehistoric fire scar (Morin-Jansen 1987). Aerial and surface monitoring of the new fire scar is tracking of the fate of the Principal Lineament and the potential development of new lineaments.

3.5.4 Geologic Hazards

Most earthquakes in Idaho occur along a belt of seismicity called the Intermountain Seismic Belt that extends from the northwest corner of Montana, along the Idaho-Wyoming border, through Utah, and into southern Nevada. Along most of its length, the Intermountain Seismic belt straddles the boundary between the extending Basin and Range Province to the west and more stable parts of North America to the east. In Idaho, the Yellowstone Hotspot has interacted with the Basin and Range to create a more complicated pattern of earthquakes and mountain building called the Yellowstone Tectonic Parabola. As a result, a major branch of the Intermountain Seismic Belt called the Central Idaho Seismic Zone extends from the Yellowstone area westward across central Idaho. This zone includes at least eight major active faults and has been the site of numerous earthquake swarms and seismic events, including the two largest historic earthquakes in the Intermountain West (Idaho Bureau of Homeland Security 2009).

The State of Idaho does not currently operate an earthquake information center that compiles data collected from seismic networks in the State. The University of Utah Seismic Center in Salt Lake City, Utah, in cooperation with the USGS, operates an extensive seismic network throughout northern Utah, the mountain ranges of the Middle Rocky Mountain Physiographic province (the Teton, Caribou, and Snake River ranges), and the Yellowstone National Park area. The INL also operates a network of 27 seismic stations within and surrounding the INL. In addition, Brigham Young University (BYU)–Idaho, formerly Ricks College, has operated a seismic station for many years (BLM 2009).

The historical earthquake record (since 1884) shows that the ESRP is seismically quiet, relative to the surrounding Basin and Range and Middle and Northern Rocky Mountain Physiographic Provinces (Idaho Bureau of Homeland Security 2009). Since the installation of the INL's seismic network in 1971, only 29 small magnitude microearthquakes (magnitude <1.5) have been detected within the ESRP (BLM 2009).

In contrast, thousands of earthquakes have occurred in the mountain ranges surrounding the ESRP, which are part of the Intermountain Seismic Belt and the Central Idaho Seismic Zone. However, only two of these quakes, the August 18, 1959 magnitude 7.3 to 7.5 Hebgen Lake quake (also known as the Yellowstone Quake) in Montana and the October 28, 1983 magnitude 6.9 Borah Peak quake, centered around Challis, Idaho, are considered significant (BLM 2009; USGS 2012a). The Hebgen Lake quake, caused by simultaneous movement on two faults, the Red Canyon Fault and the Hebgen Fault, is the largest earthquake recorded in Montana (since May 1869) (USGS 2012a). The epicenter was just west of Yellowstone National Park. The Borah Peak quake is the largest recorded in Idaho. This quake occurred in the Lost River fault zone, located just east of the Long Valley fault zone. Spectacular surface faulting was associated with this earthquake: a 21-mile (34-km) long, northwest-trending zone of fresh scarps and ground breakage on the southwest slope of the Lost River Range (USGS 2012a). Both quakes occurred in the Central Idaho Seismic Zone.

Unstable soils and areas of mass movement do exist in southeastern Idaho. However, most of these soils and areas of mass movement occur on the steeper slopes of the National Forest Service lands that surround the ESRP (BLM 2009).

3.6 Soils

Soils in the Refuge have formed in Pleistocene pro-glacial deposits delivered by water and wind. Some of the soils began as stratified lenses within former lakebeds and other soils formed in dunes. The soils in the Refuge range from excessively drained loamy sands developing in eolian deposits to very poorly drained silty clays and clay loams in the relict lakebeds. The eolian deposits are subject to wind and water erosion. Permeability of the soils varies greatly both across the surface of the landscape and within soil horizons below the surface. Throughout the Refuge, soils are deep to very deep and depths to the water table vary. Soil sampling by refuge staff has uncovered historic indications of a higher water table. Additional soil sampling will be conducted in the future to determine the prior extent of seasonal high water tables within the Refuge.

Spatial and tabular soil data sets have been acquired for the Camas National Wildlife Refuge from USDA NRCS (Map 11, page 3-45). The major soil types of the Refuge are summarized in Table 3.7. These soils cover 74 percent of the refuge area. When the soil survey was made, 679 acres or 6 percent of the refuge area were classified as water (NRCS 2008).

As noted in Section 3.5 above, eolian (wind-driven) deposition of loess and sand has been an important process on the ESRP throughout the Pleistocene and Holocene periods. In recent times (both prehistorically and historically), removal and deposition of soils by prevailing southwesterly winds following fires has resulted in the formation of linear, southwest-northeast-trending features where higher dunes alternate with lower depressional areas. These “lineaments” can be seen clearly in aerial and landsat imagery. On the Refuge, this process has created alternating bands of sandier Grassy Butte soils and loamier Medano soils in upland areas, while lacustrine soils (fluvaquents, Levelton, Medano, and Psammaquents) dominate lowland areas.

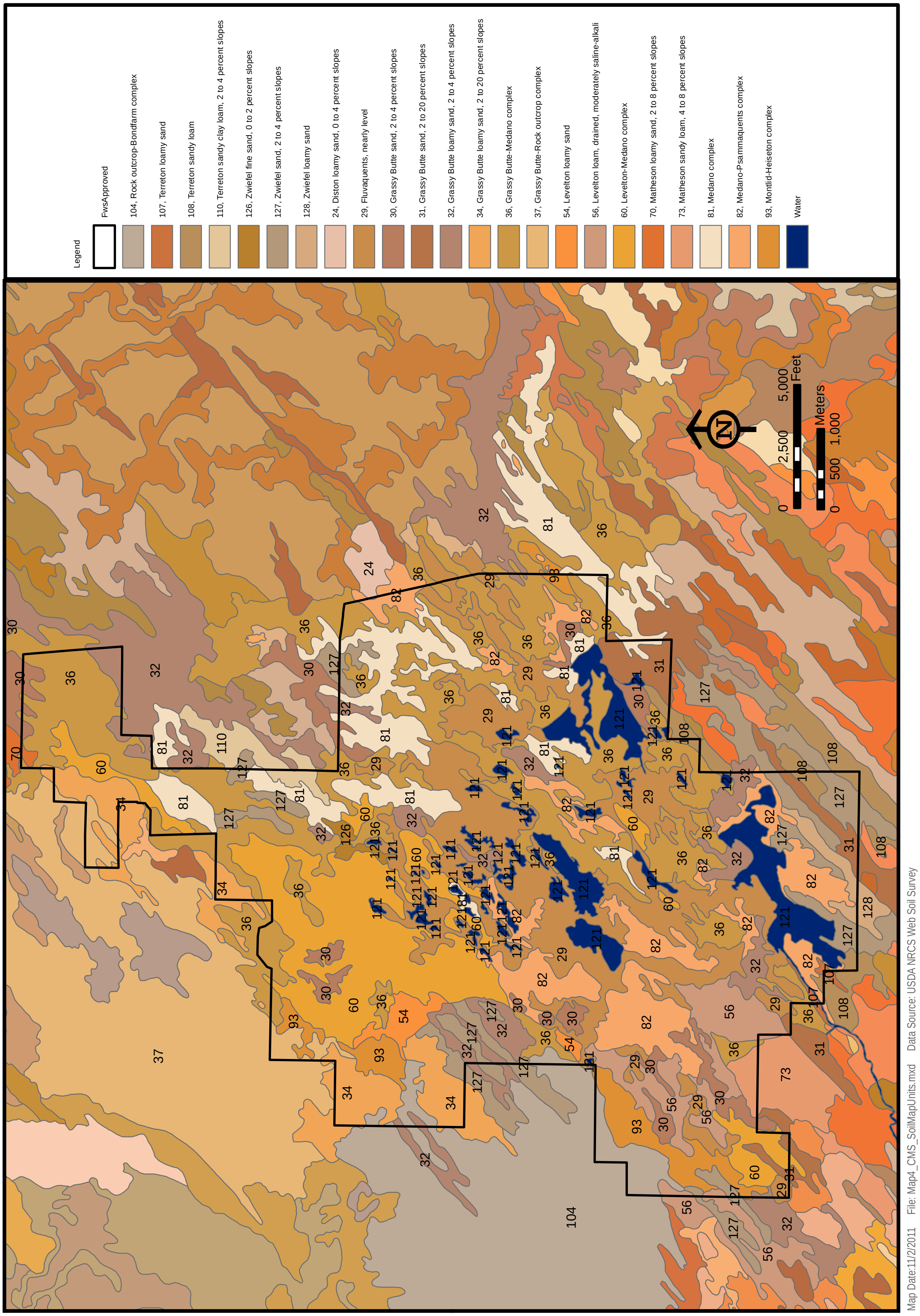
Soils are deep over much of the Refuge, but on the west side of the Refuge outcrops of basalts do occur. These outcrops are more prevalent on Table Butte, to the west of the Refuge. A small portion of the Refuge (approximately 50 acres) contains dunes (Zweifel sand), which are very prone to wind erosion (USFWS 2009).

Wind erosion is a significant concern in the refuge area. Both rangeland fires and agricultural practices that expose bare soil contribute to erosion in this region. In surrounding croplands, pasture, and CRP areas, wind erosion spiked at almost 10 tons per acre per year in 1987. Since then wind erosion has decreased to 5.5 tons per acre per year (Idaho NRCS 2007).

Table 3.7. Major Soil Types of the Camas National Wildlife Refuge

Soil Map Unit	Acres within Refuge	Percent of Acres	Summary Soil Characteristics
Grassy Butte – Medano complex This map unit consists of approximately 60% or more Grassy Butte These soils are developing in eolian deposits on relict dunes and lake beds	2,213	21%	Deep to very deep Drainage class ranges from somewhat excessively to poorly drained Sands and loamy sands Non saline
Fluvaquents, nearly level	1,870	17%	Very deep Frequently ponded, very poorly drained Silty clay over very gravelly sand (or sandy loam) Slightly saline to strongly saline
Levelton-Medano complex This map unit consists of approximately 45% Levelton and 30% Medano soils. These soils are developing in lacustrine deposits in lake beds. The Levelton soils have an organic surface horizon.	1,255	12%	Deep to very deep Poorly drained Loamy sands to clay loams Non saline to very slightly saline
Medano-Psammaquents complex This map unit consists of approximately 80 % Medano and similar soils. These soils are developing in relict lakebeds.	947	9%	Very deep Poorly drained to very poorly drained Loamy sands Non saline to very slightly saline
Grassy Butte loamy sand, 2 to 4 % slopes and **Grassy Butte** loamy sand, 2 to 20 % slopes.	856	8%	Very deep Somewhat excessively drained Sands and loamy sands Non saline
Medano complex These soils are developing in relict lakebeds.	727	7%	Very deep Poorly drained Sandy loam over loamy sand Non saline to very slightly saline

Map 11. NRCS Soil Map Units of the Camas National Wildlife Refuge



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3.6.1 Soil Drainage Classes

Soil drainage classes refer to the frequency and duration of wet periods under conditions similar to those in which the soils developed. Natural soil drainage class is a function of water table, soil wetness, landscape position and soil morphology. Soil characteristics such as redoximorphic features indicate the depth and duration of seasonal saturation for the undisturbed soil. Alteration of the water regime by human activity does not affect drainage class unless the soil morphology has been changed. There are seven soil drainage classes recognized: very poorly drained, poorly drained, somewhat poorly drained, moderately well drained, well drained, somewhat excessively drained, and excessively drained. Soil drainage classes in the Camas National Wildlife Refuge are noted in Table 3.7 above. There are few acres in the Refuge in the “moderate” drainage class. Soils are either poorly to very poorly drained, or well to somewhat excessively drained. Additionally, the soils in the watershed upstream of the Refuge are almost entirely in the “somewhat excessively drained” category. Water moves downward through these soils rapidly creating droughty surface conditions and the potential for groundwater recharge. Camas Creek is a losing reach in this section of the watershed. Water that is withdrawn from Camas Creek above the Refuge and applied as irrigation to these soils will not likely return to Camas Creek, but will slowly infiltrate to the deep aquifer below. A more detailed understanding of drainage class, soil permeability, soil horizons, and bedrock porosity will be key in efforts to conserve water and restore natural habitats on the Refuge.

3.6.2 Water Movement Through Soil

A quantitative measure of how easily water flows through soil is described by hydraulic conductivity. This depends on the permeability of the material and the degree of saturation. Saturated hydraulic conductivity varies across the landscape surface and through the depth of the soil by horizon. Saturated hydraulic conductivity classes are separated by a tenfold increase in magnitude. The higher the saturated hydraulic conductivity rating, the faster the rate at which water will flow through the soil. Soils on the Refuge vary from low to high saturated hydraulic conductivity classes. Below the surface, a rapidly conductive soil horizon may underlie a horizon of much lower conductivity, creating a feature similar to a drainage tile. Care must be taken when excavating or digging in stream channels or wetlands of the Refuge, since connecting these highly conductive soil horizons to surface water sources can lead to inadvertent drainage of wetlands or stream channels.

3.7 Fire

3.7.1 Regional fire history

Presettlement Fire History

The cold-desert climate of the Snake River Plain, with its cold, wet winters and springs and dry, hot summers predisposed many sagebrush steppe communities to an evolutionary history with recurring fire. Estimates of fire return intervals for sagebrush steppe range from ca. 20 to 100 or more years (Houston 1973; Wright et al. 1979; Wright and Bailey 1982). Wright et al. (1979) surmised that the interval between fires must have been sufficiently long for Basin big sagebrush (*Artemisia tridentata* var. *tridentata*), which does not resprout and must recolonize burned sites from seeds, to regain dominance; otherwise, the extensive areas dominated by sagebrush would have been dominated by root-sprouting shrubs such as horsebrush (*Tetradymia canescens*) or rabbitbrush (*Chrysothamnus viscidiflorus*). Nevertheless, it is clear that fire played an important role in the evolution of many plant species that constitute cold desert communities. The vast majority of shrubs and perennial grasses and forbs can survive wildfires, especially fires that occur in late summer or fall when many plants are dormant. Some species respond vigorously to postfire conditions (INL 2012c).

Post-settlement Fire History

Wildfire is currently a common hazard in the semiarid rangelands of southeast Idaho. The ESRP has a history of large, rapidly spreading wind-driven fires (5,000 to 10,000 acres). For example in 2006 the Crystal Fire, the second largest wildfire documented in southeast Idaho since 1936, burned approximately 31 percent of the "Big Desert," rangelands managed by the BLM in Southeast Idaho. The Crystal Fire burned approximately 220,000 acres/344 square miles (89,117 ha/890 square km) of grasslands and sagebrush between August 15 and August 31, 2006, and more than 40,000 acres (16,100 ha) burned in a single day (Chen et al. 2011; USGS 2012b).

In the Great Basin, the invasive introduced annual cheatgrass (*Bromus tectorum*) was introduced in the late 1800s and by the 1990s dominated 3 million acres, with another 14 million acres heavily infested and 60 million acres considered at risk for potential domination (Pellant and Hall 1994). Changes in fire regime in this habitat type due to invasion of cheatgrass are leading to conversion of sagebrush to annual grasses and demise of species dependent upon sagebrush. In more xeric sagebrush ecosystems, exotic annual grasses have become more dominant at the expense of native perennial species, and these annuals have shifted mean fire return intervals from more than 50 years to less than 10 years in some places (Whisenant 1990).

However, the eastern portion of the Snake River Plain has largely escaped the cheatgrass dominance found in the western portions of the Plain and in northern Nevada. This may be because the ESRP differs climatically from most cheatgrass-invaded areas: winter temperatures are colder and there is more late spring precipitation (Perkins et al. 2012).

At the same time, introduced annual grasses have become more common and fire frequencies on the ESRP have increased compared to historic levels. Fire frequencies and area burned per year have increased substantially in the recent decade in sagebrush steppe, to nearly 500 ha/year in some years (Sankey et al. 2008). Following wildfire, ground vegetation is typically eliminated, leaving the landscape devoid of vegetative cover. Sage-steppe and grassland communities frequently undergo a series of adverse ecological changes, such as soil erosion, invasion by introduced annual grasses (e.g., cheatgrass [*Bromus tectorum*] and Medusahead [*Taeniatherum caput-medusae*]), and long-term native species decline (Hilty et al. 2004; Pierson et al. 2002).

Compounding the problems caused by cheatgrass and other invasive species in sagebrush ecosystems, a policy of total fire prevention evolved in the 20th century based on the premise that all fires were unnatural and therefore harmful. Fire exclusion was incorporated in Federal land management policies around the turn of the 20th century (Agee 1974; Kilgore 1976; Komarek 1962a,b; Shinn 1977).

3.7.2 Refuge Fire History

Since Camas NWR was established in 1937, wildland fires have occurred infrequently. The Annual Narratives report only a handful of fires started by natural causes such as lightning. Fire suppression has been part of the Refuge's management program since establishment, since the area around the

Refuge contains numerous ranches and various outbuildings and the potential for costly property damage is possible during periods of extreme fire danger.

Records at Camas NWR from 1962 to 2009 indicate 20 wildland fires occurred, burning 1,216 acres of the Refuge. Fourteen of these fires occurred between 1983 and 2009, burning 1,190 acres of the Refuge (Table 3.8 below). Of these fourteen fires, five were caused by lighting, one by burning on adjacent land, six by downed power lines or electrical shorts in irrigation pumps, and two were escaped prescribed fires. The largest, the Sandhole fire in 1987, caused by debris burning on adjacent private land, was 327 acres; the smallest involved one cottonwood tree.

The Independence and Buck Springs fires were started by lightning that hit the Camas NWR area about 2:00AM on August 12, 2003. The Independence Fire was located on the southwest corner of the Refuge just west of the Independent Ditch. The fire burned a total of 136 acres, all on refuge land. The Buck Springs Fire was located on the west side of Camas NWR. This fire started in the West Marsh Unit and spread off-Refuge onto adjacent BLM ground. This fire burned a total of 251 acres, 105 acres of which was refuge land. Fire crews arrived on the scene of the fires about 4:00 AM and successfully cut off potential spread of the fires into sage-steppe habitat to the west. The Buck Springs Fire was contained on August 13 and declared controlled on August 14. The Independent Fire was contained on August 13 and declared controlled on August 15 (USFWS 2003).

Table 3.8. Wildland Fires at Camas NWR 1983-2009

Date	Fire Name	Acres	Cause
04/23/87	Sandhole	327	Adjacent landowner burning
09/06/90	Quarters #2	5	Equipment use (down power line)
06/05/92	Well #7	1	Undetermined (electrical short in pump)
08/28/92	Powerline	30	Equipment use (down power line)
07/28/96	Rat Farm	115	Lightning strike
08/01	Unknown	120	Downed power line
2000	Camas	116	Lightning
2003	Beaver Creek	2	Lightning
08/12/2003	Buck Springs	251.9 (105 on Refuge)	Lightning
08/12/2003	Independence	136	Lightning
2004	Power Line	0.1	
2007	Camas	7	Equipment use
4/20/2009	Independent Wildfire	55	Escaped prescribed fire (acres burned is in addition to prescribed fire treatment area)
2009	Mallard Wildfire	171	Escaped prescribed fire

Sources: Refuge data; USFWS 2001.

Although the historical incidence of wildland fires at Camas NWR has been low, there is a potential for extreme fire situations both on the Refuge and along the north and western boundary of the Refuge. The fire risk at Camas NWR is considered moderate to high due to its location amid ranches, private dwellings, and refuge facilities. Private property borders two thirds of the Refuge; BLM land borders the west side of the Refuge. Numerous private residences are located on the refuge boundary in the northeast section. The federally listed Community at Risk of Hamer, Idaho, borders the Refuge on the southeast side.

BLM lands adjacent to the Refuge's western boundary contain dense stands of sagebrush and grass. These areas are highly combustible during late summer and drought years due to low fuel moisture content. The adjoining lands along the east and south boundary are mostly irrigated cropland. The Refuge has numerous gravel and two-track roads which break up the vegetation continuity and act as firebreaks. Since the Refuge is relatively flat, elevation and aspect differences on the Refuge contribute little to fire behavior. Fire behavior on the Refuge is affected mostly by vegetative density and wind influences. Most fires tend to burn at slow to moderate speed unless gusty or strong winds are present. The exception would be fires in dense bulrush or cattail which could generate enough heat to produce their own localized wind conditions (USFWS 2001).

The normal fire season for the Refuge is March to October. The majority of the fires have occurred in July and August. After snow melt in early spring Camas NWR can experience a short potential for fire starts before the vegetation greens up. During the drought year of 2007 Camas NWR vegetation did not green up, staying cured all summer. The vegetation usually cures out at Camas by the end of June or early July. Vegetation in emergent wetlands (e.g. bulrush) does not cure out until the end of September; however it may cure out earlier in drought years. Most of the Refuge (approximately 9,948 of the Refuge's 10,578 acres) is considered burnable.

The vegetation/habitat types at Camas are broken down into the following (for more detail see Chapter 4):

- **Sagebrush/grassland**: in climax stage, the site is dominated by Basin big sagebrush, arrowleaf balsamroot, Indian ricegrass, and needle- and-thread grass (*Hesperostipa comata*). Green rabbitbrush also occurs and represents the early seral stage of sage-steppe community. Approximately 1,200 acres has been seeded with crested wheatgrass. Knapweed and various other weed species are also present.
- **Wet Meadow**: dominated by Baltic rush and various sedges.
- **Marsh**: dominated by hardstem bulrush and broadleaf cattail.
- **Semiwet Meadow**: dominated by saline tolerant plants such as inland saltgrass, alkali bluegrass and alkali sacaton. This habitat appears as narrow strips between the Wet Meadow and Marsh sites.
- **Riparian**: dominated by narrow-leaf willow (also called sandbar or coyote willow); the majority of the willows are located adjacent to Rays Lake in the southern portion of the Refuge. A narrow band of willow grows along sections of Camas Creek. Cottonwood trees represent non-native shelterbelt vegetation and mostly grow in the refuge headquarters area bordering Camas Creek.

Table 3.9. Fuel Model Composition for Camas NWR

Habitat Type	Fuel Model	Acres in Fire Regime Class	% of Refuge
Sagebrush/grasslands (native and non-native)	FM 2/6	3,633 acres	34%
Wet Meadow	FM 1	2,956 acres	28%
Permanent and semipermanent wetlands	FM 3	2,401 acres	23%

Semiwet Meadow	FM 1	853 acres	8%
Riparian	FM 4	105 acres	1%
Open water/mud flats		630 acres	6%

3.8 Environmental Contaminants

In 2004 USFWS staff completed a Contaminants Assessment Process (CAP) for the Camas Refuge (Arena 2004). The CAP gathered existing information and made an initial assessment of contaminants of concern to fish and wildlife resources. The CAP reviewed literature, studies and internal USFWS reports relevant to the area surrounding the Refuge. The CAP considered both ground and surface water contamination.

The INL is located approximately 12 miles from Camas Refuge. INL is owned by the U.S. Department of Energy (DOE) and covers a total of 890 square miles. Since it began operation in 1949, INL facilities produced environmental contaminants via groundwater injection wells, surface discharge of liquid effluents, and airborne emissions.

Atmospheric mercury: In 2001, a study sponsored by the INL was undertaken on Sandhole Lake. The purpose of the study was to investigate sediment core samples from Sandhole Lake in order to reconstruct atmospheric mercury fallout trends from pre-INL times to the present. The impetus of this study was the operation of a thermal liquid waste treatment process (calciner) on the INL, which emitted 50 kg/yr Hg^{+2} to the atmosphere over a 36-year period (1964-2000). The sediment core studies indicated an increase of mercury over time. Results are inconclusive, however, as to where the mercury originated from. No obvious correlation was observed between local source flux over time and annual emissions from the INL calciner (Arena 2004).

Agricultural runoff: Camas Creek receives surface water runoff and sediment input from upstream agricultural areas. Contaminants may be leached from soils used for agriculture and may be conveyed to the Refuge by Camas Creek. Some of the contaminants associated with agriculture runoff are known to cause adverse effects to fish and wildlife resources when present at elevated concentrations. One farm in particular (Larsen Farms), lies directly upstream of the Refuge. There are over 5,000 acres of potato, alfalfa, and wheat agricultural lands on Larsen Farms, over 1,600 acres of which are permitted for application of wastewater from their potato processing plant. All discharge from the processing plant is applied via the wastewater application permit; there is no direct discharge into any of the surrounding creeks, all discharge is land applied. In addition, at least nine different chemicals are applied to the agriculture land, mostly during the summer months June through August. The method of chemical application varies, but includes ground application, aerial application, or chemigation (application through the irrigation system). Four of the nine chemicals being used on Larsen Farms (Discover, Quadris, Ridomil-Copper, and Baythroid) are considered highly toxic to aquatic organisms, and four (Discover, Sencor, Diquat/Reglone, Baythroid) are considered slightly to moderately toxic to birds/waterfowl (Arena 2004). Further investigation of agricultural runoff constituents would facilitate determination of whether concentrations present in Camas Creek, within the refuge boundary, are sufficient to pose a threat to fish and wildlife resources.

Minimal water quality data for the Refuge exist. However, in an evaluation of contamination in Camas Creek from deposition of herbicides upstream (USFWS 2006), organic and inorganic test results were non-significant. The only results above the detection limit were total nitrogen levels. All other organics and sediment and water samples were below the laboratory detection limits.

3.9 Air Quality

The Idaho Department of Environmental Quality (DEQ) monitors air and water quality at several locations around the State. Landowners burn irrigation ditches to reduce vegetation that can block water flows; sometimes they burn crop residue; and they regularly burn rubbish piles. Jefferson County is subject to temperature inversions when air movement is restricted, so poor air quality can be exacerbated at these times. Both agricultural burning and wildfires may impact Camas Refuge air quality during periods of low winds and stagnant air masses. Inversions occur intermittently throughout southeast Idaho, and may last for several weeks. There also are periods of stagnant air in the summer that may result in air quality alerts, typically when temperatures exceed 95 degrees (Arena 2004).

By exposing soil, both agricultural practices and range fires contribute to dust storms in the area. These occur more often in spring prior to agriculture planting, and in late summer/fall after harvest. Wind erosion can be severe at these times and the problem can be compounded if farmers have burned their crop residue. Blowing soil and dust has been severe enough to close major roadways. During the summer, air quality can be adversely affected by the occasional dust storm and wildfires (BLM 2009). The prevailing wind direction on an annual basis in the Camas Refuge area is from the west-southwest. Near the surface, a southwesterly wind in most common, as it tends to closely follow the confines of the topography, blowing from the southwest to the northeast, up the Snake River Plain. Westerly and southwesterly winds can transport agricultural dust and/or suspended particulate matter onto the Refuge from agricultural areas and from the INL (Arena 2004).

3.10 Water Quality

3.10.1 Clean Water Act

The State of Idaho has established water quality standards that have been approved by the U.S. Environmental Protection Agency (EPA) in order to meet the requirements of the Clean Water Act. In Idaho, the DEQ administers the State water quality program. ID DEQ develops water quality standards and monitors streams and rivers to assess the level of pollutants in the surface waters of the State. In order to develop standards for a water body, ID DEQ must first designate the beneficial use(s) of the water in question. Idaho has identified the following beneficial uses: aquatic life, water supply, recreation, wildlife habitats and aesthetics. Most water bodies will have more than one beneficial use. The beneficial uses of Camas Creek are classified as Primary Contact Recreation, Salmonid Spawning, and Cold Water Aquatic Life by the Idaho DEQ. Beaver Creek has beneficial uses classified as Domestic Water Supply, Primary Contact Recreation, Salmonid Spawning, and Cold Water Aquatic Life by IDEQ.

Section 303(d) if the Clean Water Act establishes requirements for states and tribes to identify and prioritize water bodies that do not meet water quality standards. Idaho must develop a water quality improvement plan, called a total maximum daily load (TMDL), for those water bodies not found to be meeting water quality standards.

TMDLs have been developed for sediment and temperature for the upper section of all streams in the basin (above the Refuge). Riparian grazing is the principal source of temperature and sediment loading to the watershed. Because the lower segments of these streams are flow altered (irrigation) and naturally lose water to groundwater, IDEQ recommends delisting them for sediment and temperature and re-listing them as flow-altered (IDEQ 2005a).

3.10.2 Surface Water Quality

Beaver Creek flows from the north into the Refuge where it continues for 0.5 miles before joining Camas Creek. This segment of Beaver Creek qualifies for 303(d) listing for flow alteration, habitat alteration, nutrients, sediment, and temperature. However, since streamflows in Beaver Creek are altered such that perennial flows are rarely seen in this segment, no TMDLs were developed for this reach on the Refuge (Idaho DEQ 2005b).

Camas Creek is 303(d) listed throughout its length, from the headwaters to the mouth. Within the Refuge, the listing is for flow alteration, nutrients, and sediment (See Table 3.10 below). The Beaver-Camas Watershed Assessment (Idaho NRCS 2007) notes agriculture and grazing are sources of soil erosion in the watershed. The watershed assessment also observes that agriculture and grazing contribute nutrients and organics to the waterways. The NRCS document lists numerous agricultural and rangeland management practices that could be implemented to improve water quality and quantity.

The water quality concerns in the Beaver-Camas subbasin stem from nonpoint sources. Nonpoint source pollutants originate from multiple points across the landscape (such as surface erosion and runoff from agriculture). The Clean Water Act controls water pollution by regulating point sources the discharge pollutants directly into water. Point sources are discrete conveyances such as pipes or ditches. Industrial and municipal facilities must obtain National Pollutant Discharge Elimination System (NPDES) permits if they discharge directly to surface waters. The NPDES permits closest to Camas National Wildlife Refuge are 25 miles to the east, outside of HUC 17040214, in an area that is not connected to the watershed (U.S. EPA 2013).

Table 3.10. Listed Waterbodies at the Camas National Wildlife Refuge

List ID	Waterbody Name	Miles on Refuge	Latest Listing	Impairment
ID17040214SK001_06	Camas Creek – (Beaver Creek to Mud Lake)	10.35	2008	Not Supporting Cold Water Aquatic Life *Sediment *Nutrients (Suspected)
ID17040214SK003_05	Beaver Creek – (Beaver Creek canal to mouth)	0.49	2008	Not Supporting Cold Water Aquatic Life *Other flow regime alterations *Physical substrate habitat alterations

Source: IDEQ 2011

3.10.3 Groundwater Quality

INL: A 50-year history of waste disposal at the INL has resulted in measurable concentrations of waste contaminants in the ESRP aquifer. Known contaminants include hexavalent chromium, I-129, tritium, and trichloroethylene (TCE). An extensive groundwater monitoring effort, led by USGS in cooperation with the DOE, is underway in order to understand the movement of fate of these contaminants in the regional aquifer. The monitoring is used in modeling efforts to simulate both contaminant movement in the aquifer and the slow release of residual contamination for wastes left buried in shallow pits and trenches. The direction of regional groundwater flow in this section of the aquifer is southwesterly—away from Camas Refuge (Ackerman et al. 2010).

Agriculture: As an internally drained basin with highly permeable surface materials, the Camas basin is particularly vulnerable to groundwater contamination. Added risk to groundwater is posed by the concentration of agricultural lands around the Refuge. The ESRP aquifer underlying the basin is extremely productive and important to both the ecology and economy of the region. The IDWR ranks the ESRP aquifer as having a high to very high potential for groundwater contamination (Van Steeter et al. 2002).

In 1998, Idaho State Department of Agriculture conducted a groundwater quality monitoring program in the Mud Lake region in order to characterize degradation of groundwater quality by contaminants leaching from agricultural sources. Results were published in 2002 (Carlson et al. 2002).

Nitrates: Groundwater quality monitoring for nitrates indicates a slight increasing trend in groundwater nitrate concentrations over time. During the 4-year period (1998-2001) in which the ISDA sampled, no samples from the 30 wells in the study exceeded the EPA Maximum Contaminant Level (MCL) of 10 mg/L. However, five wells south of Mud Lake along State Highway 33 consistently sampled above 5 mg/L of nitrate, leading IDEQ to establish a nitrate area of concern near Mud Lake.

Pesticides: Pesticide sampling was conducted at all 30 wells in the Mud Lake groundwater quality monitoring study in 1998. Several pesticide compounds were detected in the 1998 samples but no pesticides were detected in follow up sampling in 1999, 2000, or 2001. ISDA has concluded that groundwater contamination by pesticides in the Mud Lake area is minimal (Carlson et al. 2002).

3.11 Visual Quality

Visibility is the major determinant of visual quality. Visual quality has major impacts to the visitors' experience of the Refuge. On clear days, mountains on the Teton, Centennial and Beaverhead ranges are visible from the Refuge. The most distant of these ranges lie more than 50 miles from the Refuge. These form the scenic backdrop which makes the Refuge a popular destination for wildlife photographers.

Visibility is generally described as the maximum distance that an observer can see a landscape viewed against the background sky. It also refers to the clarity with which the texture, form, color, and details of the landscape appear. Visibility is how far we see and how clear the view appears. Visibility impairment is one of the most obvious indicators of pollution in the air. Air pollution can cause light to be absorbed or scattered, thereby affecting the image we see. The pollution and resulting changes in light are referred to as "haze." In Idaho, most haze is a result of smoke from fires, and dust. Depending on the source(s) of the haze, it may be localized or transported into the area by wind (BLM 2009).

The 1999 amendments to the Clean Air Act (CAA) set forth a national goal for visibility. The rule, referred to as the Regional Haze Rule, calls for states to establish goals and emission reduction strategies for improving visibility in all Class I areas (national parks and wilderness areas). The CAA Regional Haze Rule requires states to set “Reasonable Progress Goals” toward improving visibility in the nation’s national parks and wilderness areas, which are designated as Class I areas. The goal envisioned by the drafters of the Regional Haze Rule is that visibility in Class I areas will return to natural conditions within 60 years. Without haze, the natural visual range would be approximately 140 mi in the western U.S. The rule requires states to develop 10-year plans to demonstrate progress toward that goal. Idaho will be setting reasonable progress goals to improve and protect primarily by addressing the three major haze-causing pollutants, nitrogen oxides, particulate matter, and sulfur dioxide.

The two closest Class I areas to the Refuge, for which visibility data are available, are Craters of the Moon National Monument and Preserve and Yellowstone National Park. Data comparing the best and worst visibility days at Craters of the Moon show poor visibility most often occurs in the winter; when air stagnation events create inversions, conditions cause pollutant levels to rise. During these episodes, visibility is impacted by higher levels of nitrates and sulfates, which contribute to the formation of fine particulates. In the summer, visibility impairment occurs less frequently. Visibility impairment in the summertime results from higher levels of organic matter, usually attributed to wildland fires. Visibility data for Craters of the Moon National Monument from 2001 through 2004 show that mean annual visual range varied from 150 to 180 mi on clear days to 100 to 110 mi on average days, to 60 to 70 mi on hazy days. Visibility data for Yellowstone National Park from 1997 through 2004 show that mean annual visual range varied from 170 to 180 mi on clear days, to 120 to 130 mi on average days, to 70 to 90 mi on hazy days (Greater Yellowstone Clean Air Partnership 1999).

3.12 Surrounding Land Uses

Camas NWR falls within the Great Basin ecosystem, which includes the high desert and mountain portions of Oregon, Nevada, Utah, Idaho and California. Stein et al. (2000) identified the Great Basin as the third most endangered ecosystem in the United States. The human population is expanding at the highest rate in the nation, and major sociological and ecological changes are occurring across the region. These changes can be attributed to numerous interacting factors including urbanization, changing technology and land use, climate change, limited water resources, altered fire regimes, invasive species, insects and disease.

In the 647,255-acre Beaver-Camas Subbasin (eight-digit Hydrologic Unit Code), of which Camas NWR is a part, 38 percent of land is privately owned and 62 percent is public land. Most of the subbasin lies in the eastern portion of Clark County; however the southern portion, including the Refuge, lies in Jefferson County. Fifty-eight percent of the watershed is shrubland or rangeland. Forest lands are located in the northern, high elevation, high relief areas of the subbasin, approximately 15 percent of total land area. Nineteen percent of the watershed is grass, pasture, or hayland, and 6 percent is cropland (Idaho NRCS 2007).

Land use in in the subbasin is primarily agriculture, with the majority of the watershed used for rangeland (64 percent). Approximately 10 percent of the subbasin is irrigated, of which half is cropland and half pastureland. The majority of the irrigated cropland (gravity flow and sprinkler) in the subbasin is located in the southern portion of the watershed where soils and topography are more amenable to crop production. A rich riparian vegetation community exists around Mud Lake; this is the smallest portion of land use in the Beaver-Camas subbasin, constituting 1 percent of the total basin area (IDEQ 2005a; USFWS 2010).

Table 3.11. Land Cover and Land Use in the Beaver-Camas Watershed

Land Cover/Land Use	Ownership					
	Public		Private		Totals	% of HUC
	Acres	%	Acres	%		
Forest	97,200	15%	2,882	1%	100, 082	15%
Grain Crops	69	1%	11,016	2%	11,085	2%
CRP* Land			3,147	1%	3,147	1%
WRP Land**			436	1%	436	1%
Grass, Pasture, Hay Lands	58,011	9%	65,541	10%	122,552	19%
Row Crops	841	1%	27,710	4%	28,551	4%
Shrub/Rangelands	239,250	37%	133,454	21%	372,704	58%
Water, Wetlands, Developed, Barren	5,353	1%	3,493	1%	8,846	1%
Idaho HUC Totals	400,724	62%	246,679	38%	647,403	100%

*CRP= Conservation Reserve Program
** WRP= Wetland Reserve Program
Source: adapted from Idaho NRCS 2007.

Table 3.12. Irrigated Lands in the Beaver-Camas Watershed

Type of Land	Acres	% of Irrigated Lands	% of HUC
Cultivated Cropland	30,000	47%	5%
Non-cultivated Cropland*	4,800	8%	1%
Pastureland	28,700	45%	4%
Total Irrigated Lands	63,500	100%	10%

*Includes permanent hayland and horticultural cropland.
Source: From Idaho NRCS 2007.

BLM shrub and rangelands are adjacent to most of the Refuge's western boundary. The BLM land is used for grazing in different allotments from spring throughout the summer. Other uses of BLM lands are hunting in the fall of the year (mostly for big game), and some horseback riding and Off Road Vehicle (ORV) use in the spring. The land is predominantly native sage-steppe habitat.

Lands adjacent to the northern, eastern, and southern boundaries of the Refuge are mostly under private ownership and are used for agriculture. Potatoes and grain (mostly spring wheat) in rotation are grown on croplands around the Refuge and are mostly under center pivot (sprinkler) irrigation. Other crops grown in the area include barley, oats, alfalfa, grass hay, and nursery stock. A few scattered tracts around the refuge boundary that are under private ownership are pasture used for cattle and recently, a limited number of sheep.

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Chapter 4
Biological Environment

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Chapter 4. Biological Environment

This chapter addresses the biological resources and habitats found on the Refuge. 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 under the Refuge Administration Act, as amended. The bulk of the chapter is then focused on the presentation of pertinent background information for habitats used by each of the Priority Resources of Concern (ROCs) and other benefitting species designated under the CCP. That background information includes descriptions, conditions and trends of habitats and threats (stresses and sources of stress) to the habitats and/or associated ROCs. This information was used to develop goals and objectives for the CCP.

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. 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 refuges and in associated ecosystems, that represents BIDEH on each refuge.

Water management is the overriding factor affecting most refuge habitat management strategies for migrating and nesting waterfowl and waterbirds. The Refuge is currently managed to provide consistent deep wetland habitats to support reliable levels of annual waterfowl production. Currently the Refuge's six "core" wetlands are flooded by diverting 58.1 cfs of Camas Creek surface flows into managed wetland impoundments. Water is pumped from wells to compensate for surface water seepage into the ground, and maintain deep wetland habitat through October. The Refuge also uses mechanical disturbance and prescribed fire to manage wetland habitat. Agricultural small grains, alfalfa, and hayed short-cover areas complement wetland habitats by providing foraging habitat for sandhill cranes, Canada geese, and other waterfowl. Haying currently occurs on approximately 150 irrigated acres of upland and wet meadow habitat annually.

In addition to wetlands, the Refuge contains willow riparian and scrub-shrub wetlands, shelterbelt, sagebrush-steppe, grassland, and agricultural habitats. Management of upland habitats (sagebrush-steppe and grasslands) management is currently limited to invasive species control and monitoring, and post-fire restoration. Recent vegetation surveys (Germino et al. 2010; Miewald et al. 2012) show significant areas of former sagebrush-steppe and wet meadow sites are now dominated by non-native plants, due to both the Refuge's past agricultural history and the spread of invasive species.

Shelterbelt habitats, which were originally created as windbreaks by local farmers and ranchers, as well as by refuge staff at the time of establishment, contain a mixture of native and non-native trees, including tall mature cottonwoods with an understory of smaller trees and shrubs. These are extensively used by migratory landbirds and are maintained by irrigation and plantings of native understory trees and shrubs.

Both the Beaver-Camas watershed and the Eastern Snake River Plain, of which Camas NWR is a part, has undergone dramatic alteration over the past century, which has ultimately affected the biological integrity, diversity, and environmental health of the region's ecosystems. There were three separate periods which led to the wetland succession and current habitat conditions at Camas NWR:

- **Pre-1915:** Historically, in periods of high snowmelt, Camas Creek would overtop its banks and inundate the surrounding area, while in low flow periods, wetlands would become desiccated following flow cessation and the onset of high summer temperatures typical of the Upper Snake River Plain. The extent of wetlands in the Camas-Mud Lake area was highly variable and fluctuated according to drought and flood conditions in the Upper Snake River Watershed. These conditions are described in section 4.1.1 below.
- **1915-1980:** The local water table rose dramatically between about 1915 and 1921 due to irrigation of the Egin Bench, 15 miles to the east. Mud Lake expanded, backing up and creating permanent and semipermanent wetlands on the Refuge. The local water table remained relatively high in the Camas area through about 1980. Artificial wetlands were easily created on the Refuge, and water levels could be quickly raised by pumping relatively small amounts of water into diked units. The high water table allowed such ponds to hold water for most, if not all, of the year (see Chapter 3, Hydrology). At the same time alterations in the timing, intensity, and duration of Camas Creek flows occurred. Overbank flooding became rare due to deepening of the Camas Creek channel (see section 4.1.2 below).
- **1980-Present:** The historic pattern of spring flood of Camas Creek, followed by natural "drawdown", or desiccation, throughout the remainder of the year, still exists but has been acutely altered in terms of timing, intensity, and duration. Camas Creek is now an intermittent stream and the average flow time through the Refuge is about two months. Due to both lowering of the water table and incision of the creek channel, minimal overbank flooding occurs (approximately one in every six years, in the late spring to early summer).

With drought conditions (1987-1992 and 2000-present), the cessation of winter recharge on the Egin Bench in 1980, and increasing groundwater withdrawals to support sprinkler (center pivot) irrigation for agricultural production in the area, the local water table has dropped compared to conditions prior to 1980. The Refuge became dependent on irrigation from wells to keep any remaining wetlands (mostly deep water marsh) hydrated long enough for brood rearing to occur. As the water table lowered, the Refuge has had to pump increasing amounts of well water to fill certain wetland basins. To date about 25 percent of managed wetlands have been placed in "inactive" status due to their inability to hold water, which appears to be due to a combination of sandy soils and the lowering water table.

The most significant changes to the region's ecosystems include:

- Changes in the hydrology of Camas Creek due to irrigation diversions;
- Expansion of center-pivot irrigation and a consequent lowering of the local water table;
- Changes in vegetative communities due to livestock grazing;
- Loss of native species, accompanied by a large influx of nonnative and invasive plants and animals into the system;
- Altered fire regimes in sage-steppe habitat.

This section discusses the connection between these landscape level changes and the current vegetation and wildlife on the lands and waters occupied by the Camas NWR. This summary is not a complete analysis of all factors related to changes in native vegetation, fish and wildlife. Much of the information presented here is based upon the planning team's knowledge of the area.

4.1.1 Historic Descriptions of Habitat and Wildlife

The complex of upland and wetland habitats on Camas NWR occupies a partial remnant of the historic Camas Creek floodplain at its interface with the Upper Snake River Valley. Camas Creek and its primary tributary, Beaver Creek, flow southwestward from the mountains into Mud Lake, the terminus of a closed basin with no natural surface-water outlet (Spinazola et al. 1992). (It is impossible to delineate a Camas Creek channel beyond Mud Lake on present-day aerial imagery.) As Camas Creek accessed the desert it would eventually disappear completely into the sandy soils and fractured basalt substrate of the northern Snake River Plain. Prior to subsiding, Camas Creek water formed a discontinuous floodplain of variable size basins (Stearns et al. 1939).

The extent and duration of inundation would vary both annually and long term (e.g., decades), depending on natural, annual precipitation in both the upper watershed, as well as in and around the floodplain itself. An appreciation for the highly variable and transient hydrologic conditions extant in historical times is critical. The exact extent of the floodplain has never been precisely established, but could conservatively be estimated at approximately 2,200 square miles (Spinazola 1993). The size of Mud Lake was estimated at only 2,500 acres in 1899, whereas the lake was surveyed at 14,200 acres in 1914 (Stearns et al. 1939). While the high lake levels seen at that time were due to a rising groundwater table on the Egin Bench (see Section 4.1.2 below), the Mud Lake playa could have filled, at least temporarily, during exceptionally wet years. During such wet cycles, an area much larger than the existing Refuge could have been inundated by the streamflow.

While it is uncertain how the Camas NWR wetlands and uplands functioned prior to development of surrounding irrigation systems and storage facilities, it is possible to infer historic function, based on examination of local geography. The Camas Creek floodplain receives runoff from southern face of the Centennial Range to the north and east. This high elevation zone of abundant snowfall would normally provide heavy spring flows, truncating to perennial summer and fall discharges in Camas Creek, through the floodplain and into the Upper Snake River Plain. The floodplain itself was situated in an area of low precipitation that would be expected to support only upland steppe-type vegetation, without the additional moisture from Camas Creek. Typically, the Camas NWR area receives approximately 10 inches of precipitation annually. In an average rain and snowfall year, Camas Creek could be expected to remain within its banks, or overflow only to a limited extent. However, occasional wet, or high moisture, years could be expected in and around the floodplain itself. During such high precipitation years, spring runoff could be expected to mix with overflow from Camas Creek channel in flood stage. The Camas floodplain would also have received water contribution from other small streams, such as Warm Creek, as well as local springs. The result of this combination of water sources would be flooding and natural irrigation of the floodplain. The relatively flat local topography did little to restrict Camas Creek flows during out-of-bank events. In such circumstances, the stream's waters probably affected a large percentage of the floodplain before disappearing into the Upper Valley sands. The Camas Creek floodplain would have likely been shallowly flooded, at least partially, for several weeks and been subjected to late summer desiccation. (Elevation change over the spring and early summer period, based on topography, basin size and surface flows currently observed, is estimated in terms of inches over the majority of the landscape, with some limited areas of greater depth.)

The interspersion of lower lying areas subject to inundation and sections of "high ground" which rarely, or never, were covered with water created a mosaic of seasonal to ephemeral wetlands (e.g., wet meadows, mudflats) and upland vegetation (grasslands and shrub steppe). This mosaic of habitat types, with wet and dry environments in close proximity to each other, would have in turn supported a wide variety of wetland- and upland-dependent plant and animal species. However, historic records indicate that at least in the recent past, the extent of permanent and semipermanent wetlands in the lower Beaver-Camas watershed was limited from the 1850s until about 1915, when irrigation from the Egin Bench raised the local water table (see Chapter 3 and Section 4.1.2 below). On the present-day Refuge, only "Sandhole" (in GLO maps from the 1880s and 90s, it is described both as a "slough" and "ponds") contained reliable, permanent water. Given the dry character of the Upper Snake River Plain, wetlands would have been primarily seasonal to ephemeral, and desiccation would have been a common condition for the historic habitats of Camas NWR.

Other natural processes such as fire and grazing by native herbivores (e.g., bison *Bison bison*, pronghorn *Antilocapra americana*, mule deer *Odocoileus hemionus*, and elk *Cervus elaphus*) would likely have been frequent, and could have been intense during certain periods. Tied to annual variation in delta, or floodplain, marsh hydrologic cycles, it is likely that fire would have occurred during late summer, drought periods; presumably triggered by lightning strikes. When conditions were right (i.e., hot, dry summer during drought), thunderstorm lightning strikes would have reduced residual cover in emergent wetland communities, as well as throughout the upland grassland and steppe sites. Due to variation in vegetative production across different floodplain sites, as well as climatic conditions at the time of ignition, these fires would have been variable, some intense and others mild, in effect. The variation in fire intensity would have produced further variation in vegetative community structure and composition, and maintained plant vigor and health through removal of residual vegetation. These short burning fires would have probably lasted a day or less, given the relatively small area of the delta. Exceptions would have been the woody riparian areas where larger diameter fuels could have supported low intensity, smoldering fires, for days to several weeks. While the frequency of these widespread fires is uncertain, they would have provided a valuable stimulus to marsh, meadow and upland succession, and ultimately, in promoting overall ecosystem health.

Hydrologic periodicity would also have influenced grazing intensity. During wet climatic cycles, traditional grazing patterns of native ungulate species may have had little influence on habitats dominated by marsh-type vegetation. Depth of water would have reduced ungulate access to the wetland sites. Conversely, during average and low precipitation years, wetland plant communities probably received inordinately high grazing use due to the attractiveness of the relatively green and lush forage these habitats provided. It is assumed that use of upland sites by native herbivores would have been continuous during all seasons, moderated primarily by their traditional movement patterns rather than the climate of a particular year. Heavy snowfall is normally not a feature of the Camas Creek floodplain, so local vegetation would have remained available throughout most winters. Again, ungulate grazing or browsing would likely have been regulated more by traditional movement patterns of these animals, than by the character of a given winter. It is also assumed that ungulate forage preference, in general, would have shifted to browse species, i.e., woody plants such as bitterbrush and willow, in upland sites during the winter, when protein demands increased.

Bison were present in substantial numbers in the Snake River Plain (Russell 1965) and bones have been discovered within Camas NWR. This suggests that bison may have frequented this area and been a significant influence on soils, vegetation and nutrient cycling. The traditional movement patterns of the herds may have been a more important factor determining bison populations and grazing pressure on the Camas Creek floodplain, than the influence of climate on bison distribution. However, it is equally possible that hydrologic effects on vegetative productivity and availability at the historic Camas NWR site may have determined the level of bison presence, use and impact on those sites. Certainly, abundant local precipitation, along with high spring flows in Camas Creek, would have produced lush wet meadow grasses along the channel and in the adjacent floodplain, as well as stimulating greater than normal grass production in nearby upland sites. All of these factors would have served to attract and keep bison in the Camas NWR area; the same is true for many of the other ungulate species using the Camas floodplain. Of course, bison are known for frequent movement, as opposed to some other species that may move less and remain in an area longer. Bison grazing likely occurred as a short duration event, as the animals moved from one location to the next.

Vegetation Communities

Early records indicate that prior to the early 1900s, the area that is now Camas NWR did not have extensive wetlands. Public land surveys in 1884 (east half) and 1899 (west half) show a feature labeled “Dry Lake” in the location of present-day Rays Lake (Figure 4.1). In the location of present-day Sandhole Lake, adjacent to a wagon road, is a feature labeled “slough.” Camas Creek meanders south to the midpoint of T7N R36 Section 30, and then veers southwest to flow into Mud Lake. The 1884 survey field notes almost exclusively characterize the vegetation as sagebrush, or bunchgrass and sagebrush (Keigley 2012). In the interior of T7N R36E, there are 60 descriptions of vegetation, almost all of which are sagebrush, or sagebrush and bunchgrass. There is a single mention of willow as the team entered Dry Lake from the east side, which may have represented an area of artesian flow. There was no mention of willow as they entered the Camas Creek channel, but this could have been an oversight (Keigley 2012). In the late 1800s, Mud Lake was a shallow, intermittent body of water (Stearns et al. 1939). In 1900 herds of cattle being driven to Arco had to be divided in half to provide access to all (Gerard 1963).

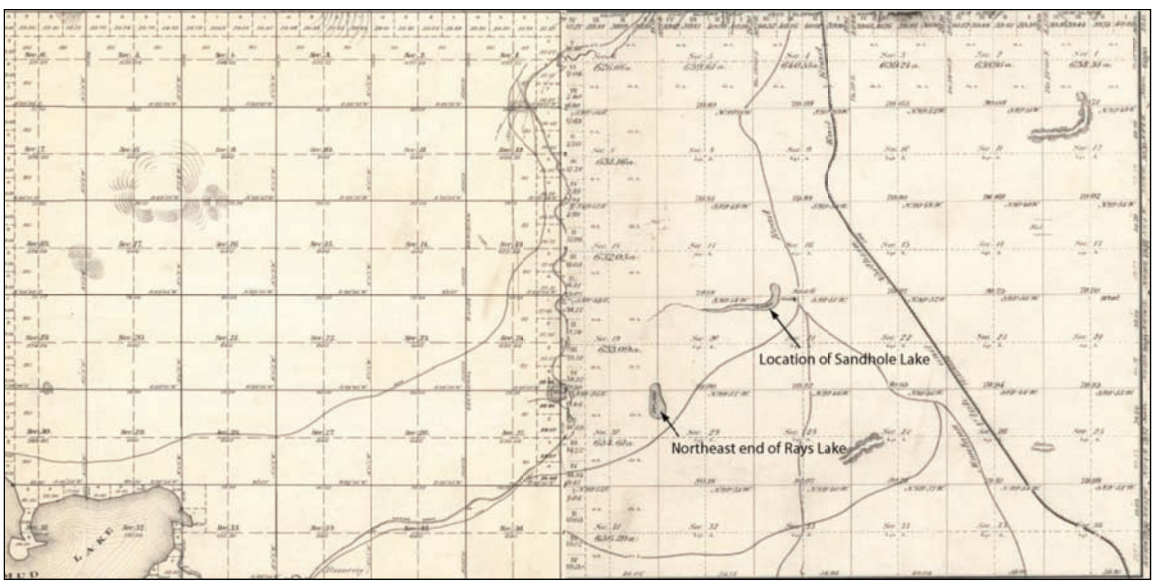

Figure 4.1. Public land survey of the Camas NWR area, 1884 and 1899.

Source: Bureau of Land Management General Land Office records (surveys).

After the area was platted, parcels were acquired by settlers. The first land patent on the Refuge was for 319 acres by Humphrey Toomey in August 1889. In 1890, Elias Ray homesteaded the E½W½ of T7N R36E Sec 30; approximately half of the area homesteaded by Ray is part of Rays Lake on the 1964 USGS topographic map. The NE¼ of Sec 30 purchased by Claude Hixson in 1904 is almost completely occupied by Rays Lake. Much of the area purchased by Sarah Richardson in 1915 (E¾S¼ T7N R36E Section 18) is now occupied by Two-way Pond. In 1901 Louis Lienemann acquired 424 acres in sections 13, 18, 19, and 24 under the Desert Land Act of 1877 (Bureau of Land Management [BLM] n.d.). Presumably these, and other settlers in the area, would not purchase land that was unsuitable for agriculture due to excessive moisture.

Given the transitory nature of overland flows in this era, the wetlands that historically existed in the Camas Creek delta likely had seasonal to ephemeral water regimes. The range health inventory team that studied Camas NWR (Germino et al. 2010) used the terms "semi-wet saline meadow" and "wet meadow" to describe different communities that would be analogous to ephemeral marsh. These sites would have been essentially the same in the historic era. The wetland and upland alliances in Table 4.1 are believed to be native to the Camas NWR area prior to Euro-American settlement (Miewald et al. 2012).

Table 4.1. Vegetation Alliances of Camas NWR

Group	Alliance
Wetlands	
Alkaline-Saline Wet Meadow Group	Saltgrass Herbaceous Alliance Alkali Sacaton Grassland Alliance
Marsh Group	Common Spikerush Herbaceous Alliance Hardstem Bulrush Herbaceous Alliance Broadleaf Cattail Herbaceous Alliance
Wet Meadow Group	Sedge (wheat, clustered field, Northwest Territory) Montane Wet Meadow Alliance
Mudflat Group	Amaranth (California, green) Mudflat Sparse Herbaceous Alliance
Woody Riparian Group	Coyote (narrowleaf) Willow Shrubland Alliance
Uplands	
Shrublands	Basin Big Sagebrush (*Artemisia tridentata* ssp. *tridentata*) Shrubland and Steppe Alliance. Needle-and thread would have been a common understory species.
	Green Rabbitbrush (*Chrysothamnus viscidiflorus*) Shrubland and Steppe Alliance. Grasses occurring within this habitat type would include needle-and-thread and western wheatgrass.
Grasslands	Western Wheatgrass (*Pascopyrum smithii*) Grassland Alliance
	Needle and Thread (*Hesperostipa comata*) Semi-Desert Grassland Alliance. Other grasses in this habitat type included Sandberg bluegrass (*Poa secunda*) and Barkworth Indian ricegrass (*Achnatherum hymenoides*, Syn: *Oryzopsis hymenoides*).

Source: Miewald et al. 2012.

Birds

Historically, upland birds, particularly sage and sharp-tailed grouse, were abundant on the upper Snake River Plain. The exploitation of these species followed the same patterns as large game and waterfowl/shorebirds. Initial human use, whether by indigenous peoples or Euro-American migrants, would have been subsistence-oriented and probably incidental to the hunting of large ungulates. Over time, subsistence use evolved into focused commercial use and, finally, sport hunting.

Before agricultural development of the region starting in the late 1800s, temporary to seasonal wet meadow habitat would have been supported by overbank flows of Camas Creek, and ephemeral wetlands created by flooding of mudflats and playas (e.g., Mud Lake and “Dry Lake” in the location of present-day Rays Lake) in wet years. Wet meadows would have provided habitat for sandhill cranes and black terns while ephemeral wetlands would have supported species such as avocets and phalaropes. During wetter climactic cycles, an expanded Mud Lake would have provided foraging opportunities for piscivorous birds (e.g., white pelicans, grebes).

Mammals

Although, bison no longer exist in the Upper Snake River Plain, a relict population of pronghorn remains, as well as a mule deer population that is presumably much reduced from historic levels. It is generally assumed that the remaining ungulate species persist at radically different diversities and densities on the Refuge today, albeit at perhaps similar geographic locations, when compared to the historic situation. Similar to pronghorn, Shiras moose are still present within the Camas Creek floodplain, put probably at lower densities than historically. Refuge Rocky Mountain elk numbers are probably similar to the precontact period, but their distribution is skewed much more heavily toward the Refuge as compared to surrounding private lands. Alternatively, white-tailed deer, which are abundant on the Refuge, as well as surrounding agricultural lands, were probably not present in large numbers in southeastern Idaho during the pre-settlement era (Anderson 1940).

Fish

Yellowstone cutthroat trout would likely have been present in the Camas Creek drainage historically. Other fishes likely would have included native sculpin (*Cottus* spp.) (Garren 2010), Utah sucker (*Catostomus ardens*), and minnows (Myler 2010.)

4.1.2 Changes to Wildlife and Habitat Since 1800

The area surrounding what is now Camas NWR was inhabited seasonally by pre-Shoshonean and Shoshone peoples for thousands of years (Hutchison and Jones 1993). These peoples used a variety of wildlife (Derig 1996) and plants in a subsistence (hunting and gathering) lifestyle. Their use of natural resources did not generate any discernible long-term negative environmental impacts, at least none that were recorded in the historical record (see below).

Collectively, hundreds of fur trappers used this area, trapping beaver and other fur-bearers (otter, muskrat, mink) (Gowans 2005; Russell 1965; Utley 1997; Wishart 1979) and hunting big game (bison, pronghorn, bighorn sheep, elk and mule deer) in an unsustainable manner (Wuerthner 1986a, b). For example, in the 1820s bison and other large game were abundant throughout the area (Russell 1965), but by 1834 trader Warren Ferris was already noticing declines (Wuerthner 1986b). By the late 1840s Shoshones had to leave the Snake River Plain and hunt bison in Montana and Wyoming, and by 1860 bison were nearly extirpated from Idaho altogether (Wuerthner 1986a, b). Other large game declined apace.

It is logical to assume, given the presence of trappers and fur traders in the area and at least some of their journal accounts, that historically beaver were much more common in and adjacent to the perennial middle and upper reaches of Camas Creek and Beaver Creek than they are today, wherever suitable habitat occurred. It is likely that beaver in the Beaver-Camas watershed suffered the same declines due to unregulated trapping that other beaver populations in the region experienced. The large scale fur trade in beavers ended by 1845, largely due to changes in fashion (Wishart 1979), but trapping for other furbearers (mink, otter) and subsistence hunting for mule deer, white-tailed deer, and elk continued in the region through the 1860s (Anderson 1940).

The Upper Snake River Plain, including the Camas Creek terminus, was used as a travel corridor during the exploration and fur trade era. As the fur trade waned, numbers of immigrants travelling through the Snake River Plain increased. This created additional hunting pressure, as well as altering habitats through drayage stock grazing.

Starting in the late 1800s, livestock grazing and homesteading activities served to both directly reduce numbers of wildlife and to reduce, or degrade, the amount of suitable habitat remaining. As Camas Creek was developed for irrigation, irrigation interests would have removed beaver since they interfered with irrigation development and delivery of water to agricultural crops. Significant alteration of habitat was also realized through road and railroad construction that supported the new farms and communities.

Agricultural Development

One of the most far-reaching impacts on Camas Creek, throughout the stream course, as well as its delta, was the advent of irrigation for farming and supplemental grazing. Construction of dams, diversion structures and ditches began early in the Upper Snake Plain, at first as small scale efforts by individual homesteaders at the field, or pasture level. Over time, the size, complexity, and environmental impacts of irrigation projects increased, as neighboring farmers and communities collaborated on larger-scale developments. The Desert-Land Act of 1877, which amended the Homestead Act of 1862, was intended to promote the reclamation of arid and semi-arid public lands by making them available for privately-managed irrigation developments. The act offered up to 640 acres (2.6 km^2) of land to an adult married couple, or 320 acres (1.3 km^2) to an individual, who would pay $1.25 an acre and promise to irrigate the land within three years. Individuals taking advantage of the act were required to submit proof of their efforts to irrigate the land within three years (Landstrom 1954). Many of the Refuge’s original homesteaders, including Humphrey Toomey in 1889, applied for patents under this Act.

Over time, the size, complexity, and environmental impacts of irrigation projects increased, as neighboring farmers and communities collaborated on larger-scale developments. These efforts were aided by the Desert Land Act (Carey Act) of 1894, and the Reclamation Act of 1902, which allowed the development of large, complex irrigation projects that removed water from rivers and delivered it to rich desert soils. To encourage settlement in drier regions, the Carey Act offered up to 1 million acres of federal land to anyone who could irrigate it (using either public or private funding), and turn it into farmland within 10 years.

Large-scale agricultural development had three major effects on the area that would later become Camas NWR: first, a rise in the local water table starting about 1915, due to subirrigation of the Egin Bench 15 miles east of the Refuge (Keigley 2012); second, changes to the duration and intensity of Camas Creek flows and alteration of the channel; and third, lowering of the water table due to the expansion of center pivot irrigation starting in the 1980s. This, combined with cutoff of water to the canals on Egin Bench in the winter of 1979-1980 (a water rights issue) and drought conditions in the region, has resulted in lowering water tables (Keigley 2012).

Egin Bench development causes rise in local water table. The following discussion is derived from Keigley (2012). The first evidence that hydrology was changing in the area occurred about 1900, when standing water was noticed about a mile north of present-day Hamer. Residents soon connected those pools of water with Egin Bench, about 15 miles east, where irrigation had begun in 1895. Prior to irrigation in the late 1800s, Egin Bench was sand and sagebrush (Young 1980). To make the land suitable for agriculture, water from the Snake and Teton River system was brought to the bench, and distributed by a network of canals. As was the practice of the day, crops were subirrigated. The water table beneath the bench was 100 feet deep, and the overlying substrate is extremely porous (Stearns et al. 1939). To subirrigate, the water table had to be raised from a depth of 100 feet, almost to the surface. This produced an immense body of water (estimated at 326,000 acre-feet) in porous soil, some of which leaked to the north and then to the west, ultimately arriving in the Mud Lake Basin.

Stearns and Bryan (1925) found two water tables in the Mud Lake Basin. There was a shallow water table that was perched above a deep water table about 250-275 feet below. Locally, the shallow water table consisted of water flowing through porous volcanic rock that was confined at the top and bottom by impermeable clay layers. This water could potentially be released as artesian flow. Some of the water leaking from Egin Bench flowed down Camas Creek into Mud Lake. Some of the water moved through the confined aquifer, and if it penetrated the upper clay layer, emerged as artesian springs or wells.

Figure 4.2 below is from Stearns et al. (1939). The blue cross-hatch describes the area of artesian flow. Note that both the slough and Dry Lake mapped in the 1884 survey are located within this artesian area. The tiny wetland area mapped in 1884 must reflect artesian output in the absence of irrigation from Egin Bench. As this map indicates (as well as one prepared by Stearns in 1921), a substantial area had become wet, either from artesian flow or from leakage out of Camas Creek. The change from dry to wet appears to have happened rapidly. As mentioned above, Sarah Richardson acquired her property in 1915. Six years later, the area is a wetland on a map prepared in 1921 (published in Stearns and Bryan 1925). Many settlers were flooded out and left the area permanently (Stayley and Hartwell 1982).

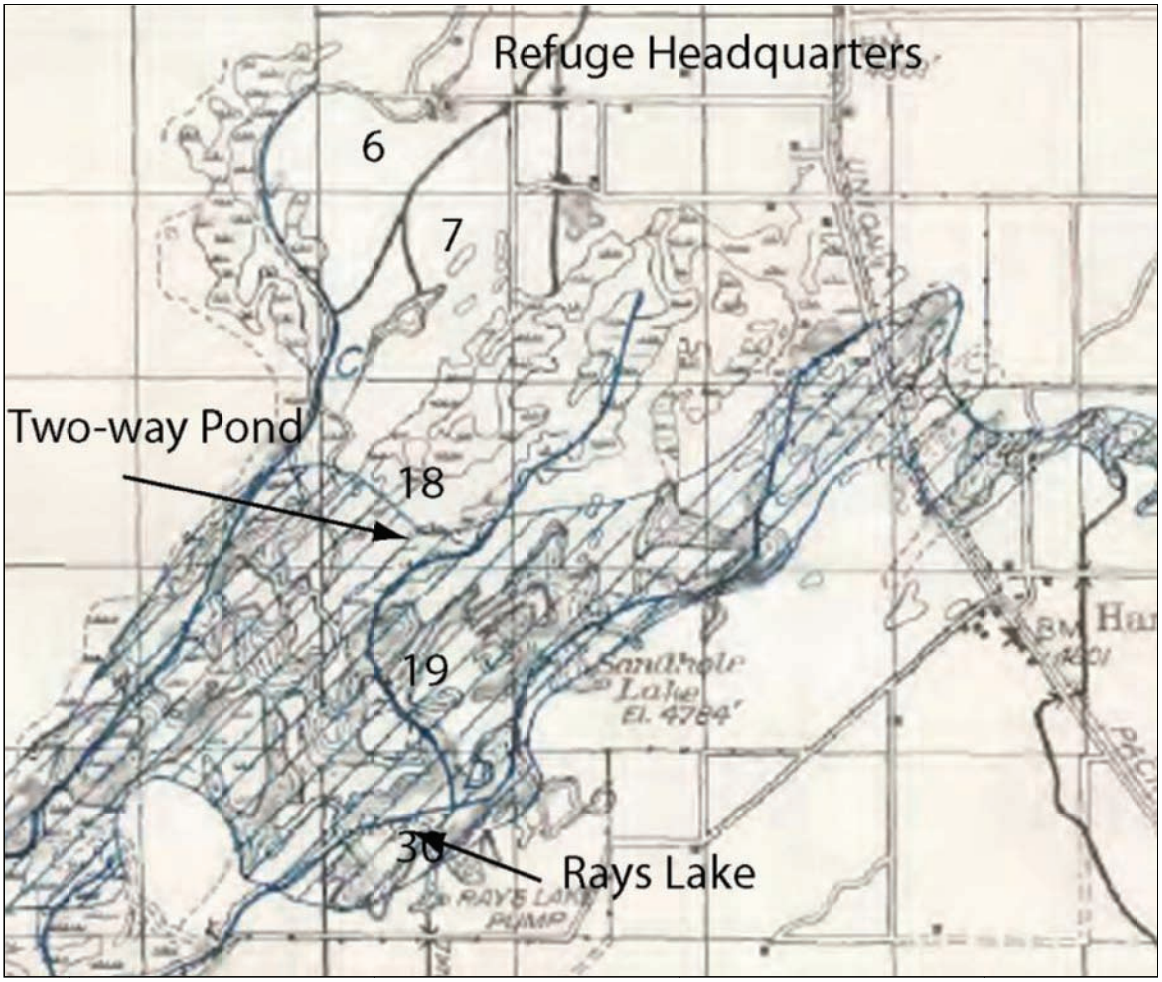

Figure 4.2. The Cama NWR area in the mid 1920s through late 1930s. Blue cross hatch indicates area of artesian flow. Mud Lake is to the southwest.

From Stearns et al. 1939.

What caused Rays Lake to form? In part it could be influenced by the same water that was wetting the areas to the north such as at Two-way Pond. This would be a combination of leakage from Camas Creek and artesian release. But for reasons described below, changes at Mud Lake may have had a significant influence on the formation of Rays Lake.

Little changed at Mud Lake until 1908. From 1908 to 1914 the lake rose about 5 feet, increasing in surface area from 2,460 acres to 14,200 acres. In the 1920s settlers constructed dikes to halt flooding of their land, ultimately creating an impoundment that allowed Mud Lake to rise 8 feet (Idaho Office of the Attorney General 1988). While most of the water entering Mud Lake flows through Camas Creek, some was input from springs at the bottom of the lake (this would be water flowing through the confined aquifer described above). Stearns and Bryan (1925) estimated the artesian discharge at 4,200 to 9,300 acre feet per year. If storage increased enough, water would flow up Camas Creek, where it would be redirected into what had been Dry Lake. This appears to have happened in June 1921 when storage reached 55,000 acre-feet (Stearns et al. 1939).

The changes at Rays Lake occurred rapidly. George and William Bird acquired the SE¼ of section 30 in 1912, presumably with the expectation of farming. Ten years later, farming was impossible. The map below shows the area submerged in 1921 when Mud Lake exceeded 55,000 acre-feet (Stearns et al. 1939). That amount was exceeded again in 1922, 1923, 1924, and 1926 (data from USGS). The map shows Sandhole Lake and Rays Lake at more or less their present size, as well as numerous areas of marsh in lower topographic areas. After the Refuge was established, these shallow basins were modified to increase the acreage of deepwater wetlands for waterfowl production. Keigley (2012) believes that willows were expanding away from “Dry Lake” (now Rays Lake) for a few years before 1921, the year by which this, and adjacent areas, were mapped as wetlands (Stearns and Bryan 1925). Much of the establishment of willows at Rays Lake was likely from clonal root sprouting. In some years, conditions may have been appropriate for establishment from seed.

Prior to 1921, water flowed through the Rays Lake area into Mud Lake. If backflow was the dominant factor in determining water level in Rays Lake, then the lake would only fill when storage in Mud Lake exceeded 55,000 acre-feet. A dike was constructed in the 1960s on Camas Creek between Rays Lake and Mud Lake, which markedly increased the tendency of Rays Lake to flood (Idaho Department of Water Resources 2010).

During this era of abundant water, wetlands would have been deeper, with more permanent water regimes than they had been historically. Plant species would have been native species that have the ability to quickly colonize wetland sites. Wetland types of the Camas Creek floodplain would likely have included perennial emergent hemi-marsh (open water, submerged aquatic plants, shallow and deep emergent habitat), ephemeral marsh (wet meadows, alkaline meadows), palustrine forested or scrub-shrub wetlands, and riparian wetlands associated with Camas Creek (Cowardin et al. 1979). Palustrine forested/shrub wetlands were likely dominated by tree and shrub forms of willow (*Salix* spp.).

The wetlands that developed in what was essentially the delta of Camas Creek when the local water table rose ca. 1915 (see Chapter 3) provided a vast and productive area of marshes, meadows and ponds that would in turn have attracted migratory waterfowl and waterbirds. The interspersion of shallow and deep wetlands, intermixed with upland habitat, created extensive irregular shorelines that would have yielded ample opportunities for waterfowl, shorebirds, and wading birds to feed, nest, and loaf. This patchy habitat was also highly productive, providing abundant plant, invertebrate, and fish resources for a diverse suite of wetland birds.

Waterfowl would have included essentially the same suite of species observed in the area today: trumpeter swans (*Cygnus buccinator*), tundra swans (*Cygnus columbianus*), Canada geese (*Branta canadensis moffiti*), lesser snow geese (*Anser caerulescens caerulescens*), Ross’ geese (*Anser rossii*), canvasbacks (*Aythya valisneria*), redheads (*Athya americana*), lesser scaup (*Athya affinis*), ring-necked ducks (*Athya collaris*), common goldeneyes (*Bucephala clangula*), Barrow’s goldeneyes (*Bucephala islandica*), buffleheads (*Bucephala albeola*), ruddy ducks (*Oxyura jamaicensis*), mallards (*Anas platyrhynchos*), pintails (*Anas acuta*), American wigeons (*Anas americana*), gadwalls (*Anas streptera*), shovelers (*Anas clypeata*), American green-winged teal (*Anas crecca*), cinnamon teal (*Anas cyanoptera*), and blue-winged teal (*Anas discors*). Wading and shorebirds included greater sandhill cranes (*Grus canadensis tabida*), long-billed curlews (*Numenius americanus*), willet (*Catroptrophorus semipalmatus*), greater yellowlegs (*Tringa melanoleuca*), lesser yellowlegs (*Tringa flavipes*), and common snipe (*Gallinago gallinago*).

The mid and upper elevation reaches of Camas Creek and Beaver Creek would have historically held numerous beaver (*Castor canadensis*) (Russell 1965; Utley 1997) as well as mink (*Neovison vison*), muskrats (*Ondatra zibethica*), and river otters (*Lutra canadensis*) (Anderson 1940; Gowans 2005). While we have no historical data on furbearer presence or abundance, it is likely that populations of muskrats and other furbearers increased in the Camas area, along with the expansion of permanent and semipermanent wetlands.

Degradation of Camas Creek wetlands. In areas with low precipitation, such as the Camas Creek region, the effect of surface water cannot be overemphasized. The availability and application of surface flows as irrigation water are key to agricultural potential in such climatic regions, and can increase crop production by several orders of magnitude. As the flows of Camas Creek and its tributaries began to be increasingly diverted from the natural channels, and with increasing ditch and evapotranspirational losses reducing return flows, the impact on the floodplain’s wetlands and wildlife became significant. The combined effects of reduced Camas Creek flows and long-term drought patterns decreased both the size and quality of the Camas Creek wetlands. The trend of degradation continued as the regional population grew and technical irrigation abilities increased. Ultimately, as the 20th century progressed, pumps were increasingly used, first to augment surface flows from main creek channels and diversion ditches, and then to mine the Snake River Aquifer from large, deep wells. Pump capacities and well depth continued to increase and the result (again combined with a series of long-term droughts) was the lowering of the water table in the Camas Creek drainage. This was reflected by Ackerman in 1995: “The most recent trend in the flow system has been a decrease in recharge since 1987 because of an extended drought and changes in land use.”

Degradation of the Camas Creek channel. An additional impact of irrigation development, exacerbated by forestry, grazing and farming practices in the Camas Creek watershed, was the degradation of the original, natural Camas Creek channel. This degradation took three basic forms, with some interrelation among them: erosion, deposition, and channelization. The practice of clearcutting forest in the highest reaches of the Camas Creek watershed, along with overgrazing by sheep and cattle throughout the watershed, created a flashier flow regime (short-term, high-volume flows), with abnormally high sediment loads. Farming practices adjacent to much of the entire stream reach reinforced similar negative effects. These high flows and sediment loads alternately scoured the channel, widening and deepening it in some areas, while depositing sediment in other zones, depending on channel morphology and geology. Valuable riparian plant communities were damaged by bank scouring, mass wasting, and incising of the channel bottom that occurred during high flows. Further channel down-cutting was caused by irrigation interests channelizing the stream to increase flows and ultimate water yields to their points of diversion. Landowners channelized portions of the creek under the erroneous belief that stream course undulations increased erosion and that a straight channel would damage banks on their property less. A second goal of channelization was to move spring flood waters off more quickly in years when Camas Creek overflowed its banks. Channelization added to the erosive quality of Camas Creek, increasing bank erosion and stream channel down-cutting.

These impacts, along with extended dry years, have changed the duration and intensity of Camas Creek flows. The Refuge’s Annual Narratives describe the refuge portion of Camas Creek as “intermittent” since 1937. But when Camas Creek was not flowing, in most years slack water would fill the channel. During the last decade of drought conditions, Camas Creek flows have typically started in March or April and ceased in June or July. Spring flows typically last about 2 months, but can persist for as long as 4 months and have been reported to be as short as 2 weeks. Time series data from the USGS gage (USGS Station No. 1311200, Camas Creek near Camas ID) show that while the total annual flow over the period of record has increased, the number of years with zero flow in August has remained equal or even increased (USFWS 2011).

As the character of Camas Creek changed from the end of the 19th century into the 20th, a fourth anthropogenic impact began to take effect. As flows in Camas Creek began to decrease over the long term, sediment carrying capacity of the stream decreased and sediment deposition increased. Extensive and numerous sandbars began to form within the creek channel and these, in turn, were colonized by willows from the adjacent riparian community. Irrigation users felt that sediment deposition and new willow stands further blocked flow, and reduced channel capacity and irrigation diversion point yields. They began to remove sediment deposits and place the resultant overburden along the tops of the adjacent creek banks. The end result was long stretches of dike-like piles of sediment that further confined Camas Creek to the already deep channel and reduced or prevented spring flows from overtopping the banks during spring runoff. The loss of such overland flows seriously reduced nutrient cycling and environmental enrichment of habitat adjacent to Camas Creek, including the terminal flood plain and associated wetland basins.

With the deepening of the Camas Creek channel and the decrease, or loss, of spring overbank flooding, adjacent riparian plant communities suffered from lack of water. Streamside shrub riparian communities declined in vigor as the channel bottom deepened beyond reach of their roots. Adjacent meadows suffered from the lack of spring floods, as well as the lowering of the water table. Additionally, the unnaturally deepened channel began to increasingly function as an actual drain for surrounding areas, further reducing the already dwindling supply of water.

Along with the physical damage to the channel of Camas Creek and the ultimate reductions of flows came a degradation of water quality (see Chapter 3). While the original, historic character of Camas Creek water is not clearly understood, it is assumed to have been far less turbid than what is currently observed. Logging, grazing and farming in the upper watershed not only created a flashier flow regime (short-term, high-volume flows), but also increased turbidity via elevated sediment loads. This resultant decline of water quality in the Camas Creek system would have impacted native fish, particularly cutthroat trout. As the lands around Camas Creek were being settled, non-native brook trout were planted in the creek which competed with native cutthroat.

4.1.3 History of Refuge Management

Executive Order No. 7720, published October 12, 1937, established Camas Migratory Waterfowl Refuge as signed by Franklin D. Roosevelt. A large portion of land that is now the Camas NWR was purchased from Idaho Livestock Lands, Inc., which headquartered a grazing operation at the same site where the refuge headquarters now sits. With the acquisition of land also came water rights to surface water from Camas Creek and one right from Schlagel Spring. Most of these water rights were termed either “High Water Rights” or “Wild Hay Rights” in the 1931 Sauve Decree. The oldest water right is from 1883 and is the most senior right for surface waters of Camas Creek. Almost all management actions taken on Camas NWR since its establishment have been tied in one shape or form to water and the subsequent water rights (For a table of water rights, see Chapter 3).

Habitat and Water Management

It appears that immediately prior to refuge establishment, the need for water was driven mostly by livestock operations, and to a lesser degree, agriculture. Staley and Hartwell (1982) noted between about 1914 and 1920, many local farmers had left the Mud Lake/Camas area, as a rising water table caused their dikes to fail. The rising water table at the Mud Lake/Camas area was caused by subirrigation at Egin Bench, 15 miles to the east (Stearns et al. 1939). In the 1920s farmers constructed dikes to halt flooding of their land, ultimately creating an impoundment that allowed Mud Lake to rise 8 feet (Attorney General Opinion 88-2, Idaho Office of the Attorney General 1988). The area that eventually became Camas NWR was mostly too wet for crops, but continued to provide pasturage and hay fields. Providing drinking water for livestock and irrigating pastures and hay fields were essential to livestock operations in this area. It is unclear how previous owners, such as Idaho Livestock Lands, Inc., diverted water from the Camas Creek channel, but it is likely that they used small structures in channel banks and overland flooding (flood irrigation) in strategic locations where level topography made this strategy feasible.

By 1937 as the U.S. Fish and Wildlife Service began to operate Camas NWR, the surrounding lands were becoming more intensively converted to production agriculture. In December 1937 the Works Progress Administration (WPA) officially opened a work camp at Camas to begin to build infrastructure. By the end of December 44 men were working in the camp and began with cleanup of the headquarters site, fencing, and road work. The 1937 Annual Narrative also describes the construction of a permanent diversion structure for Toomey Pond. The 1939 Narrative Report states that as of July, the main diversion structure was 60 percent complete, and ten percent of the main supply channel was also complete. For the next five years the WPA crews worked on refuge headquarters buildings, fencing, building up existing roads, and building diversions and water control structures, water delivery canals, and bridges. Many of these structures are still visible and many are still in use today. Over the next four decades the Refuge continued to build up roads that also acted as dikes, with a goal of creating more deep-water habitat for waterfowl production. The Refuge also took part in the “cleaning out” of the Camas Creek channel to attempt to keep as much water as possible within the banks of the creek, and prevent water from overtopping the banks and flooding out neighbors’ or refuge crop lands. In 1947 the first centrifugal pump was installed on the Refuge to allow use of groundwater to augment Camas Creek flows to refuge wetlands. Well #1 on the north end of the Refuge was completed in 1954 and Wells 2, 3, 4, 5, and 6 (formerly called Barmwell) all had pumps and electrical service in 1958. Wells 2 and 3 were initially used mostly for agriculture while the other wells supplied wetlands. Well #8 came on line much later (1980) and was also used to augment surface flows into wetlands.

Throughout the history of the area, the flows from Camas Creek were sporadic and largely based on precipitation levels. In wet years the creek would flow year round, while in drier years little water would make it to the Refuge from the north (see Chapter 3, Hydrology). However, water was still plentiful enough to allow the Refuge to create and sustain new deep water marshes, while retaining a diversity of shallow marsh and wet meadow habitats. In the 1960s new wetland projects were brought on line, and the use of wells to fill the Refuge’s managed wetlands increased. Relatively low well water inputs were needed to keep managed wetlands full through the brood rearing season, because the water table was still relatively high. This allowed even wetlands with relatively porous, sandy substrates to retain water. In the 1980s this began to change. The water table began to drop, due to the cessation of winter recharge on the Egin Bench in 1980, the switch to pivot irrigation on the Egin Bench, and an increase in center pivot irrigation in the Camas area (see above). As the water table began to drop (and continues to do so today) many of the Refuge’s wetlands could no longer hold water through the summer, and some became dry for the majority of the year. In addition, drought conditions in the upper Snake River Plain have resulted in lower, and more intermittent, Camas Creek flows. The region experienced a severe drought in 1987-1992 and has been experiencing drought conditions for the past decade. As a result, the average flow time of Camas Creek through the Refuge is about two months annually. The Refuge became dependent on irrigation from wells to keep any remaining wetlands (mostly deep water marsh) hydrated long enough for brood rearing to occur, and currently has placed approximately 600 acres (25 percent) of its modified wetlands into inactive status.

Prescribed Fire

Prior to 2001, fire management on Camas NWR focused on controlling wildfires, both naturally caused and human-caused (for wildfire history, see Chapter 3). Prescribed fire was used infrequently on the Refuge prior to 2001 (total 134 acres, 1997-2000). (Prior to refuge establishment, farmers and ranchers may have conducted burning at times to improve livestock forage and to clear irrigation ditches and canals; however little is known about these prior management practices.) A prescribed burning program was begun on the Refuge in 2001 with a 75-acre burn completed to improve habitat conditions on Toomey Pond (Table 4.2). From 2001 to 2012, 22 prescribed fires totaling 1,756 acres have been conducted at Camas NWR. Prescribed fire units at Camas NWR have generally been small in size (100 acres or less).

Approximately 42 percent of prescribed fire, in terms of acreage, has been conducted to improve habitat conditions in wetlands, control invasive species, burn slash piles of fallen shelterbelt trees or Russian olive after they have been removed, or to clean ditches of accumulated debris and vegetation prior to the spring irrigation season. Most of these prescribed fire treatments have been in marsh habitat, to remove dense residual vegetation. A smaller amount of treatments have been in the wet and dry meadows. About 58 percent of prescribed fires by acreage have been treatments to reduce fuel loads, and therefore wildfire risk, to protect refuge or adjacent private property.

Table 4.2 Prescribed Fires at Camas NWR, 2001-2012

Fire Name	Fire #	Year	Fire Type	Total Acres
Toomey	1855	2001	Treatment	75
Redhead	A097	2003	Treatment	100
Spring Pond	1469	2004	Wildland Urban Interface	162
Camas Piles 05	1588	2005	Treatment	10
Tumble Mustard 06	A054	2006	Wildland Urban Interface	66
Willow Piles 06	A057	2006	Wildland Urban Interface	66
Field 7	A055	2006	Treatment	36
Rays Willow rx	A525	2006	Treatment	50
Camas Piles	A527	2006	Treatment	36
Rx Burning	A650	2007	Wildland Urban Interface	20
S Big Pond	A624	2007	Treatment	40
Grouse Field	1639	2008	Wildland Urban Interface	30
Field 7b	1401	2008	Treatment	30
Flat Pond	1402	2008	Treatment	62
Pc Piles	1836	2009	Wildland Urban Interface	5
Independent Rx 09	1852	2009	Wildland Urban Interface	410
Mallard Piles	1835	2009	Treatment	30
CSR Pile Rx 2010	A227	2010	Wildland Urban Interface	10
CSR Ditches A	A269	2010	Wildland Urban Interface	100

Table 4.2 Prescribed Fires at Camas NWR, 2001-2012

Fire Name	Fire #	Year	Fire Type	Total Acres
Toomey	A268	2010	Treatment	210
Q2 Rx	A475	2011	Wildland Urban Interface	28
Big Pond	W1159	2012	Wildland Urban Interface	180
			Total Acres	**1,756**

Due to constraints such as the waterfowl nesting season (mid-April to late summer), water level fluctuation, and fire season, the Refuge has two prescribed burn windows in spring and fall. As determined from past years' burn experience, the approximate burn windows are in spring (March 1 to April 15) and fall (September 20 to October 30). During these windows the above constraints can be mitigated and vegetation is cured out enough to meet prescribed burn objectives. Prescribed fire is conducted so as to protect sensitive habitats (sagebrush/grassland habitats located on the north and west side of the Refuge; riparian habitat along Camas Creek associated with headquarters); private property and residences; refuge facilities; and cultural resources.

The results of prescribed fire, in terms of habitat improvement, have been mixed to date. The 2008 Grouse Field burn was done to remove non-native vegetation (e.g., cheatgrass and smooth brome) from a field that was being prepared for a native grass and forb restoration and met this objective. However spring burns in areas where Canada thistle already exists, may result in at least temporary increases of this weed. The 2010 burn of Toomey Pond was conducted reasonably early in the spring with the goal of reducing the amount of dense, tall emergent wetland vegetation (bulrush and cattails) that had built up over time in that wetland unit. This burn was not successful in meeting the stated objective because the soil was still frozen, protecting the roots of these plants, which resprouted later in the season. On the other hand, the 2012 Big Pond burn was conducted later in the spring and after a mild winter. This fire burned hot enough to kill the roots of emergent vegetation, leading to a noticeable reduction of density and size of the emergent vegetation in this wetland unit. To date, no monitoring efforts have been put in place to quantify post-fire habitat conditions or treatment results for either wildfire or prescribed burns. This points to the need for measurable biological objectives in future fire plans.

In 2009 two separate prescribed fires escaped their boundaries. The Mallard Slough prescribed fire was the first, when slash piles initially surrounded by snow, escaped and burned 172 acres eight days after the fire was ignited. The Independent prescribed fire was ignited on April 20th 2009, less than one mile to the southwest while broadcast-burning light to moderate grass. The objective of the prescribed fire was to consume 95 to 100 percent of the grass in the 410-acre burn unit to reduce hazardous fuels and create favorable wildlife habitat conditions. The escaped fire burned an additional 55 acres (including some willow riparian vegetation), all on refuge land (USFWS 2009a).

Grazing

Livestock grazing continued after the USFWS purchased the lands that are now Camas NWR. In 1938, then Assistant Refuge Manager Howard J. Sargent wrote in the annual narrative: "On basis of observations during this quarter it appears necessary or at least desirable to either eliminate grazing on most of the Refuge or build sufficient interior fence to protect pothole and marsh areas." Both grazing (20-25 permittees) and winter feeding (normally two or three permittees) of livestock were permitted uses of Camas NWR in the early years. The 1952 annual narrative reported that 33 grazing permits were issued, for a total of 5,353 AUMs. Grazing levels remained fairly static into the 1970s, with the possible exception of lower levels during extreme dry conditions. The last winter feeding operation was terminated in 1969. In the 1980 Annual Narrative, then Manager Jack Richardson reported that 4,620 AUMs were leased from Camas NWR, and mentions the possible elimination of grazing from the Refuge.

On October 22, 1992, the National Audubon Society, the Wilderness Society, Defenders of Wildlife, Black Hills Audubon Society, and Alan D. Riley filed a complaint for declaratory judgment and injunctive relief against Manual Lujan, Jr., Secretary of the Interior; John F. Turner, Director, U.S. Fish and Wildlife Service; and U.S. Fish and Wildlife Service. The complaint challenged the actions of the Service in authorizing and allowing secondary uses of the National Wildlife Refuge System, such as grazing, military air exercises, motorboating, and watersports, without ensuring that such uses are compatible with the purposes of the national wildlife refuges on which they occur. The Service agreed to a settlement on October 21, 1993. The settlement agreement required that the Service "review all secondary uses on all national wildlife refuges to ensure that they are compatible with the major purposes for which the respective units were established" (USFWS 1994). Grazing on Camas NWR was discontinued as part of the settlement agreement in this litigation. The last permits were issued in 1993 and since then, interior fencing has gradually been removed.

Haying and Farming

Camas NWR began to produce crops for waterfowl and forage for livestock in the early 1940s. The 1940 Annual Narrative reported that millet was sown in shallow wetland areas on the Refuge. In 1941, 5 acres near the headquarters site were plowed, disced, and seeded to non-native crested wheatgrass (which was planted extensively in the region at that time, for both livestock forage and soil stabilization). In 1942 two five-acre patches near Sandhole Lake were broken and planted to barley, and 40 acres near the refuge headquarters planted to small grain (sharecrop). By 1947 it was reported that 240 acres of the Refuge were being farmed for grain production. Between 1944 and 1945, 100 pounds of crested wheatgrass was broadcast seeded near Rays Lake. In 1949 1,000 pounds of millet were planted in around ponds, and 1,000 pounds of sweetclover planted on the west side of Independent Ditch.

The intensity of the refuge farming program increased in the 1950s. In 1950, 160 acres of new ground were broken for grain production and 500 pounds of yellow sweetclover were seeded at various sites. In an effort to increase early season forage for livestock, Camas NWR planted one ton of brome grass seed received from Medicine Lake NWR and one ton of crested wheatgrass seed from Slade NWR. The 1956 annual narrative reports that 20 acres of refuge lands were leveled for farming purposes. By the mid to late 1960s, approximately 500 acres of land on the Refuge had been leveled to increase the production of small grain crops. One of the reasons for this major increase in cropping was to support the Animal Damage Control (ADC) program, and the trumpeter swan and whooping crane recovery programs at Red Rock Lakes NWR and Grays Lake NWR in the 1970s. Grain from Camas NWR was shipped to the Pocatello Supply Depot for use by ADC, while grain was shipped to Red Rock Lakes NWR to feed trumpeter swans as part of the swan recovery program. In early 1970s, Grays Lake NWR received grain from Camas for a whooping crane project. In 1977 Camas NWR was relieved of these duties, and grain production was immediately reduced.

By 1981 the annual narrative reported that only 160 acres of refuge lands were still in crop production. By the late 1980s cropped acres had been further reduced to 70 acres. From the late 1980s to the present day, acres in crop production have ranged from 120 to 160 acres and grain production has been de-emphasized in favor of legumes (alfalfa) which provides not only green forage for geese and other waterfowl, but benefits to sage-grouse, white-faced ibis, long-billed curlew, and Swainson's hawk. Currently most of the Refuge's 160 farmed acres are in irrigated alfalfa (140 acres), while only 20 acres are in small grain (winter wheat or barley). All crops are currently produced under cooperative agreements with local farmers.

Tree Plantings

As the area was homesteaded most settlers planted trees, at least around buildings to provide protection from wind and shade in the summer. It is likely that Idaho Livestock Lands, Inc. had planted some trees around what is now the refuge headquarters site, as well as on other lands acquired by the Refuge. The large cottonwoods near the refuge headquarters date from prior to refuge establishment. Once the Refuge was established, additional trees were planted to benefit wildlife. In 1940, 2,000 Russian olive trees were planted at various locations on the Refuge, along with 375 chokecherry, 600 hawthorn, 200 currant, 700 black willow, and 300 wild plum trees. Ground juniper, white fir and spruce were also planted at the headquarters site in that same year. In 1941, 4,000 more Russian olive and 300 *Caragana* (Siberian pea) were planted. In 1947, 60 black willows were planted near Quarters #2. In 1956, IDFG personnel planted 2,300 Russian olive and 20 ash trees near the headquarters site and Quarters #2. In 1958, large numbers of lilacs were moved to the headquarters area. In 1971, Russian olive, Siberian elm, and Siberian pea were planted on refuge lands.

The importance of this mostly non-native shelterbelt habitat to landbird migration was brought to light in a study conducted by Jay Carlisle in 2005 and 2006 (Carlisle et al. 2008). Dr. Carlisle found that the landbird migrants using the shelterbelt habitat around the refuge headquarters were making significant weight gain, which was vital for the journey these birds were making to and from their breeding grounds (see Section 4.4.3 below). After this study, some carefully planned tree plantings were undertaken at the headquarters site to attempt to replace some the trees that were dead or already lost, with native species.

Wildlife Releases

At least two wildlife releases were conducted on Camas NWR in the early 1940s. On October 4, 1940, 60 chukars (*Alectoris chukar*) were released on the Refuge with hopes of establishing a self-sustaining population. Because of the lack of suitable habitat on the Refuge, these birds quickly disappeared. It appears that this was the only attempt to release chukars on the Refuge, and similar releases on the Snake River Plain met with the same fate. In 1941, 30 Hungarian partridge were released for the first time on refuge property. It appears that there were multiple releases of Hungarian partridge on the Refuge, particularly during the 1960s and 1970s when some local kennel clubs were allowed to host dog trials on the Refuge. Other species of birds may have been released as well, but records are not available. Hungarian partridge still exist on the Refuge today, in relatively low numbers.

In 1983 in a cooperative effort, Utah Power and Light, the Peregrine Fund, and the IDFG erected hack towers for the release of peregrine falcons in certain locations in eastern Idaho. One of these sites was on Camas NWR. That first year, three young were hacked to the tower and two eventually fledged. In 1984 five young falcons were hacked to the site and all five fledged. In 1988 as preparations were being made to hack more young to the tower at Camas NWR, it was discovered that an adult pair of peregrine falcons were using this tower as a nest site. No young were hacked to the tower that year to allow territory establishment. 1989 saw three peregrines fledged from the tower, from a resident pair of falcons. Since then, falcons have nested successfully on this site in most years.

Fisheries

No major work or effort has ever been put into management of fishery resources on Camas NWR, but some observations were reported in the annual narratives. In the 1938 annual narrative it was noted that catfish and perch were observed in Sandhole Lake. In 1939 crappie were planted in Sandhole Lake, and trout were observed in Independent Ditch. Perch and chubs were observed in Camas Creek in 1941, and in 1942 trout were observed at Buck Springs, Camas Creek, Mallard Slough, and Warm Creek. Observations in 1944 were: 2- to 3-inch catfish in Sandhole Lake, perch in Mallard Slough, and rainbow trout at Buck Springs. In 1952, 1,500 pounds of suckers were taken in a trap on Camas Creek by a commercial fisherman. Two-Way Pond froze out in the winter of 1952 and large numbers of suckers and perch died from this event. In 1954 the IDFG, through publication of fishing rules, opened Camas NWR to public fishing. However, this was not approved by the Service and no fishing was allowed. Also in 1954, the State used rotenone in Mud Lake (Mud Lake Wildlife Management Area), refuge lakes and ponds, and Camas Creek to remove all fish. This apparently was successful and the State later stocked Camas Creek with trout and Mud Lake with bass. In 1976 the first recorded hoop netting took place on Sandhole Lake and produced one perch, Utah chubs, and seven bullheads. A yellow perch die off was recorded in Center Pond in 1979. More netting took place in 1980 on Sandhole Lake and produced Utah chubs, yellow perch, and large-mouth bass. In 1989 it was recorded that both rainbow and cutthroat trout were observed in Camas Creek. Another notable winter kill occurred in 1990 in Rays Lake. Species found were tiger muskellunge, large-mouth bass, Utah chubs, and suckers.

Today, some trout, in particular non-native brook trout, can be found in the upper reaches of Camas Creek (Garren 2010). Refuge annual narratives contain documentation of sightings of cutthroat and rainbow trout. The last recorded sighting of trout on the Refuge was in 1995 (rainbow trout in in the main diversion channel near the Well #4 outlet).

Fisheries management is not possible on Camas NWR given the current water situation. During spring flows fish do move up Camas Creek and enter the Refuge from either the northern reaches of Camas Creek or Mud Lake. All ponds or lakes on the Refuge are either dry by winter, or freeze out during the winter months.

Invasive Species Control

The first mention of invasive plants in the annual narratives was in 1941 when 10 acres of Russian knapweed were "cleaned up." In 1946 refuge personnel had started to use the herbicide 2-4D to control Canada thistle, sow thistle, and morning glory. In 1947 managers were using both herbicides and controlled burns to control knapweed. The 1953 narrative mentions the use of plowing for weed control. The use of spraying for pests was implemented in 1954 when the Refuge used a Service plane to spray 605 acres of cattails and also treat 75 acres for grasshoppers. In 1955 a mixture of 2-4D and diesel fuel was used to treat 500 acres of weeds. The first recorded release of bio-control agents (insects for the control of Canada thistle) was in 1994 and 1995. In 2009 there were four releases of stem mining weevils (*Ceutorhynchus litura*) and crown mining (seed head) weevils (*Rhinocyllus conicus*) on Camas NWR for control of Canada thistle. In 2010 the 2009 releases were supplemented with fifteen releases of stem and crown mining weevils and fifteen releases of leaf defoliating beetles (*Cassida rubiginosa*).

Wildlife Control

In 1948 the Refuge set out 200 pounds of poisoned muskrat meat to attract and kill magpies that were felt to be overpopulated and causing depredation issues. From 1951 through 1969, the Refuge also hosted, or had personnel present at, jackrabbit drives, which were intended to reduce crop and habitat damage caused by high jackrabbit populations. Five hundred people participated in the first drive and captured 2,300 jackrabbits. In 1970, the refuge manager decided that the Refuge and its staff would no longer participate in rabbit drives and ended the Service's association with those events. In recent decades, control of animals involved in off-refuge agricultural depredation has been conducted by the U.S. Department of Agriculture's Wildlife Services.

Wildlife Surveys

The history of banding waterfowl on Camas NWR dates back to the early 1950s. The first data found in the files were from 1951 when 1,916 ducks were banded. In the 1950s, between 700 and 2,000 ducks were banded per year. Banding efforts were strong in the 1960s with 1,200 to 2,700 ducks being banded annually. Winter banding was also conducted, with as many as 769 mallards being banded in January of 1966. Banding efforts decreased in the 1970s, with 500 to 1,000 mallards being banded annually, and in some years managers did not report that any banding was conducted. Banding resumed in the 1990s, but only 200 and 450 ducks were banded annually. The last recorded banding effort occurred in 1995 when 242 ducks were banded at Camas NWR. In 2001 the banding permit for Camas NWR had become inactive and has not been reactivated.

Sagebrush-Steppe Habitat Restoration

Recently, Camas NWR staff has conducted sage-steppe restoration on previously farmed refuge lands. Two different treatment sites were selected (15.7 acres and 14.0 acres, total 29.7 acres). Both sites were burned in the fall of 2008 and then sprayed with glyphosate in the spring and fall of 2009. The two sites were further split into four treatment areas and all seeded with the same native grass and forb mix. Three different treatments were applied: (1) seeding only (two areas), (2) disking twice, and harrowing before seeding (one area); and (3) spraying with imazapic after seeding (one area). The newly seeded areas were not irrigated and are part of a demonstration project to see if the seeding can survive without irrigation. The seeded area is being monitored with permanent study transects and plots.

4.1.4 Changes in Wildlife Populations after Refuge Establishment

Historically, the Camas area hosted a diverse and abundant wildlife that used an attractive mosaic of habitats with a vigorous and healthy flora. Depending on species, wildlife used these habitats both seasonally, and year round. The combined influences of climatic change and anthropogenically induced hydrogeologic degradation, combined with early human overuse of the local natural resources, have led to declines in the majority of wildlife species. These declines are generally continuing to present day, but vary in intensity. A few wildlife species, such as white-tailed deer and Rocky Mountain elk, have increased or are increasing, but the permanence of those proliferations are uncertain. While not the only limiting factor on wildlife populations and habitat condition, the decline of water availability and quality in the Camas Creek Basin is a major cause of declining habitat quality and therefore, wildlife populations as well.

Birds

Continental passerine, waterfowl, and waterbird populations have changed considerably since the Refuge was established in 1937, and refuge populations have fluctuated widely through time. In some cases species abundance has declined, due to habitat changes and other causes. The loss of many habitats, including breeding wetlands, regionally and nationally increases the importance of remaining areas like Camas NWR, although the Refuge itself has certainly experienced declines in extent and/or quality of some habitats.

Use of the Refuge by trumpeter swans, Canada geese, and many species of breeding waterfowl increased dramatically after establishment. This generally followed the recovery of the continental waterfowl populations in the late 1930s, as drought conditions eased and hunting was regulated to ensure sustainable wildlife populations. Construction of impoundments and wetlands on the Refuge, along with farming for wildlife, probably resulted in local increases in waterfowl populations, although the significance of this new wildlife-centric management to duck, goose and swan populations on the continental or flyway level is unclear. Refuge managers and biologists of the period tended to ascribe recovering waterfowl numbers generally to both improving climatic conditions and more intensive habitat management.

Waterfowl data from refuge Annual Narrative Reports are presented in Section 4.4.1 below. Peak spring waterfowl estimates varied widely from year to year, with a low of 8,000 in 1948 to a high of 197,000 in 1979. In 1982, the last year for which data are available, the peak spring count was 25,000. Peak fall waterfowl estimates varied from a low of 9,585 in 1962, to a high of 200,000 in 1946. In 1991, the last year for which data are available, the fall peak was 65,000. Since then, fall peaks appear to be much lower, because the Refuge now typically holds little open water in the fall. Waterfowl production was reported at 18,000 in 1943; the low figure was 905 in 1959. In dry years, production was in the 1,700-2,000 range, while in wetter years, production was in the 4,000-9,000 range. In recent years, production has probably been relatively low, due to the lower acreage of wetlands that remain hydrated through the brood-rearing season.

Mammals

Camas Refuge has historically supported a diverse community of large ungulates. Five species occur on the Refuge: elk, moose, mule deer, white-tailed deer, and pronghorn. Data are presented in section 4.4.2 below. Populations and densities of these five species have been highly variable since refuge establishment. Elk and moose populations have increased since refuge establishment: initial records are of sporadic individual sightings, followed by a trend of slow growth over decades. The area's elk population has increased dramatically from early historical records. Accounts of trappers in the mid-1800s suggest that elk were common, though buffalo and bighorn sheep were more numerous. Unregulated harvest of the late 1800s and early 1900s reduced populations to relatively low levels. By 1952, elk were believed to be numerous enough to warrant the first hunting season. Since then, elk have continued to increase, likely as a result of the combination of forage (e.g., alfalfa) on farmlands, and the security provided by refuge habitat (see section 4.4.2 below).

Idaho's mule deer population has fluctuated widely at least since the early 1800s, and likely previous to that time. Early accounts from that period indicated that deer were less numerous than buffalo, bighorn sheep, and elk. Deer declined through the early 1900s, probably due to unregulated harvest. By 1920 deer were quite rare. From 1920 to the early 1970s, deer numbers increased dramatically, interrupted briefly by significant winter mortality. Following a significant decline in numbers beginning in 1972, numbers again increased. In 1975 mule deer surpassed pronghorn as the most abundant ungulate on the Refuge. Numbers peaked at 200 in 1992. Both on the Refuge and throughout Idaho, mule deer experienced high mortality in the winter of 1992-1993. The refuge herd has never recovered and mule deer are now rarely seen on the Refuge. White-tailed deer were absent from the Camas NWR area, or at least unobserved, until 1972 and then only sporadically recorded for approximately 10 more years. In the mid-1980s, reports of white-tailed deer began to increase rapidly and were beginning to surpass mule deer numbers by the mid-1990s.

Pronghorn were maintaining the largest herds of any of the ungulates at refuge establishment and continued relatively stable for several decades. Peak numbers recorded on the Refuge were about 350 animals in the early 1950s. As with mule deer, pronghorn populations have declined, not only at the Refuge but across the western states (Rachael 2010). Currently, pronghorn herds are the smallest of any refuge ungulate, excepting mule deer. There is currently a small herd of 20-50 pronghorn that can regularly be found within the Refuge.

Muskrats are a flagship species when considering marsh function and health. These rodents are “ecosystem engineers” that maintain a balance between tall emergent vegetation and open water areas within wetlands, especially the deeper and more permanent basins. We have been unable to locate historic data on muskrat populations or harvest on the Camas Creek marshes. However, it is likely that muskrat populations were historically low in the refuge area but increased as the water table rose in the early 1900s. It is likely that muskrat populations declined from early refuge levels.

There are no population estimates for other mammals, such as bobcats (*Lynx rufus*), coyotes (*Canis latrans*), red fox (*Vulpes vulpes*), striped skunks (*Mephitis mephitis*), spotted skunks (*Spilogale putorius*), raccoons (*Procyon lotor*), badgers (*Taxidea taxus*), river otter (*Lutra canadensis*), beaver (*Castor canadensis*), mink (*Neovison vison*), and weasels (*Mustela* spp.). Occasionally populations are mentioned as “high” or “low” in refuge annual narratives, but these are subjective assessments at best. Historically coyote, badger and spotted skunk would likely have been the most abundant medium-sized predators in the region, while red fox, raccoon and striped skunk would have been rare or absent. The red fox, as an example, was considered to be absent from the uplands of eastern Idaho and rarely present on in the Snake River Plain, if at all. The development of farms and ranches in the area created conditions favorable to the more adaptable red fox, raccoon, and striped skunk, while increased human populations and activity have been detrimental to the coyote, badger and spotted skunk. However, we have been unable to locate Camas NWR records to locally substantiate this theory. Mountain lion (*Felis concolor*) and black bear (*Ursus americanus*) have both been observed on Camas NWR, but their occurrence is very rare. Refuge habitat is not suitable for long-term occupancy by these species. Mink also occur, but again, reliable population estimates are not available.

Fish

Native fishes, especially Camas Creek populations of Yellowstone cutthroat trout, have declined from historic populations. Since the character of Camas Creek has declined to a seasonal stream, we assume no trout of any species survive within the refuge boundaries, except during spring runoff events. Under these circumstances, Yellowstone cutthroat trout, as well as non-native brook trout and rainbow trout, are washed down from the upper reaches of the stream. There are few data on other fishes of the Camas Creek floodplain, other than suckers (probably Utah suckers), being prominently mentioned by Manager Richardson in the 1979-1993 annual narrative reports as being very abundant, particularly during low water periods.

Reptiles, Amphibians, and Invertebrates

There are little refuge data on reptiles or amphibians, and Camas NWR generally appears to have a low-to-moderately abundant herpetofauna. Subjectively, the amphibian populations do not appear to be particularly diverse or robust. This is no doubt a function of the Refuge's xeric (dry) nature, sandy soils, rocky sites and very cold winters. There are no data on species present, or population trends for any reptile or amphibian species. The only minor, organized survey to date was an extensive one-day search for malformed northern leopard frog metamorphs on July 17 and 30, 2009. That limited survey yielded no amphibians of any species and only one aquatic reptile, a painted turtle. We suspect that this investigation severely underestimates the existing amphibians at Camas, but it nonetheless gives a sense of the relatively low occurrence of this class on the Refuge. As with herptiles, there is little information on terrestrial or aquatic invertebrates, despite growing recognition of their ecological importance.

4.2 Selection of Priority Resources of Concern

4.2.1 Selection Process

Early in the planning process, the planning team identified 40 focal species (resources of concern) for the Refuge, as recommended under the Service's *Policy on Habitat Management Plans* (620 FW 1). In this policy, resources of concern (ROCs) are defined as:

> 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)

The Service's Draft *Identifying Resources of Concern and Management Priorities for a Refuge: A Handbook* (USFWS 2009c) states that "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. (Resources of concern are called *conservation targets* in conservation planning methodologies used by other agencies and NGOs.) These priority resources of concern (ROCs) frame the development of goals and objectives for wildlife and habitat. Resources of concern may be species, species groups, or features that the Refuge would 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 (see "Other Benefitting Species," Table 4.4). Negative features of the landscape, such as invasive plants, may demand a large part of the refuge management effort, but are not designated as resources of concern.

Achieving healthy, functional ecosystems for native fish, wildlife, and plants on the Refuge can be described through the habitat requirements of “focal species” highly associated with important attributes or conditions within habitat types. As described by Altman (2000), the rationale for using focal species is to emphasize habitat attributes most in need of conservation or most essential for functional ecosystems. By managing for a group of species (guild) representative of important components in a functioning ecosystem, the elements of biological integrity, diversity, and environmental health will also be addressed. Focal species are a prioritized subset of the Camas NWR Resources of Concern from Appendix E and represent legally mandated species and natural communities for management of Camas NWR. The species selected as priority resources of concern support the following NWRS mandates:

- Support the Refuge’s establishing purposes and the NWRS mission;
- Conserve biological integrity, diversity, and environmental health;
- Fulfill USFWS trust resource responsibilities (migratory birds, threatened and endangered species, interjurisdictional fish, and marine mammals);
- High regional conservation priority.

A description of the methodology used to select focal species for this CCP follows.

Selection of Focal Species

Refuge staff extensively documented and reviewed thirteen regional, flyway, and State plans or lists to classify the conservation status and management priority of Camas NWR fish, wildlife, and plant species (Appendix E: Resources of Concern). Seven of these plans predominately center on avian species (e.g., birds, shorebirds, waterbirds, waterfowl). Four plans or lists prioritized not only avian species, but all species of great conservation need. Of these four plans, the Idaho Conservation Strategy for Southeast Idaho Wetlands is the narrowest in scope, focusing singularly on wetland habitats. The Idaho Fish and Game Idaho Comprehensive Wildlife Conservation Strategy, priority species list of the USFWS Partners for Fish and Wildlife program, and The Nature Conservancy (TNC) Ecoregional Assessments for the Columbia Plateau identified and ranked the conservation need for a suite of species across multiple habitats.

Subset of Resources of Concern

The list of 292 Resources of Concern (Appendix E) was narrowed down to a smaller subset for Camas NWR. The subset of Camas NWR Resources of Concern (Appendix E, Table E-5) contains 153 species of the greatest conservation need, including 36 of the 88 species identified in the Snake River Basalts Section of the Idaho Comprehensive Wildlife Conservation Strategy (ICWCS). The 36 ICWCS species that inhabit Camas NWR consist of 34 birds, seven mammals, one amphibian, and one reptile. An additional fifteen ICWCS species with State rankings of S1 (Critically Imperiled), S2 (Imperiled), or S3 (Vulnerable) and not identified as Camas Section species of the greatest conservation need and not identified on any other regional conservation plan, but known to inhabit Camas NWR, were added to the refuge subset of Resources of Concern list. Thirty-seven species identified in the TNC Ecoregional Assessments were included in the subset list, as were 20 USFWS Birds of Conservation Concern from Region 1 (n=12), BCR 9-Great Basin (n=14), and BCR 10-Northern Rockies (n=12). A total of 46 high priority and 34 moderate priority birds from the Idaho Partners in Flight Plan, and nine high priority and six moderate priority birds from the Intermountain West Regional Shorebird Plan, were identified for the subset list of Resources of Concern. The subset list also includes 36 BLM sensitive species, consisting of 31 birds, three mammals, one amphibian, and one reptile of Type 1 (1); Type 2 (4); Type 3 (18); Type 4 (1); and Type 5 (12) BLM rankings. Fifteen waterfowl species of moderately high or greater breeding or non-breeding priority in BCR 9, as identified in the North America Waterfowl Management Plan, were included in the subset. The Conservation Strategy for Southeastern Idaho Wetlands identified sixteen species-of-concern, including one bird (double-crested cormorant) not found in any other plan or list reviewed. The North America Waterbird Conservation Plan identified one high, nine moderate, and four low priority species of conservation concern that inhabit Camas NWR. Refuge staff also performed an internal assessment of refuge species that contribute significantly to impacting (positively or negatively) the biological integrity, diversity, and environmental health of the Refuge, but are not found in any other conservation plan or list. This assessment yielded nine additional species for the subset list of Resources of Concern for Camas NWR.

Focal Resources

Refuge staff selectively filtered the list of Focal Resources for Camas NWR (Appendix E, Table E-5) and developed a Resources of Concern list of species, which represent the collective needs of the larger groups of species or communities on the Refuge. In total, 40 representative focal species were identified for Camas NWR (Table 4.3). Collectively, these 40 focal species represent the requisite wildlife life-histories required in the management of the seven wetland and upland habitat types of Camas NWR (Table 4.4).

Additional tables that support this chapter are located in Appendix E and include a Comprehensive List of Resources of Concern (both species and habitat types), and Biological Integrity, Diversity, Environmental Health tables that describe habitat types, key ecological processes, and limiting factors. In Section 4.3, we consider the condition and trends of the habitat types that support these focal wildlife species. In Section 4.4, we consider condition and trends of populations of key species and species groups on the Camas NWR.

Table 4.3. Priority Resources of Concern (Focal Species, n= 40) for Camas NWR

Swans
Trumpeter swan
Geese
Canada goose
Dabbling Ducks
Cinnamon teal
Northern pintail
Northern shoveler
Diving Waterbirds
Lesser scaup Redhead
Grebes
Eared grebe
Pelicans and Cormorants
American white pelican
Wading Birds
American avocet
Sandhill crane
Marsh Birds
White-faced ibis
Shorebirds
Long-billed curlew
Marbled godwit
Common snipe
Terns and Gulls
Franklin's gull
Raptors
Bald eagle
Short-eared owl
Peregrine falcon American kestrel
Upland Game Birds
Sage grouse
Woodpeckers
Downy woodpecker
Flycatchers
Willow flycatcher Olive-sided flycatcher Western wood-pewee
Mockingbirds and Thrashers
Sage thrasher
Shrikes
Loggerhead shrike
Vireos
Warbling vireo
Warblers

Table 4.3. Priority Resources of Concern (Focal Species, n= 40) for Camas NWR

Yellow warbler
Blackbirds, Meadowlarks, Orioles
Western meadowlark
Mammals
Ground squirrel spp.
Pygmy rabbit Sagebrush vole Mink
Muskrat Elk White-tailed deer Pronghorn Moose
Amphibians
Northern leopard frog

Table 4.4. Focal Species Comparison by Breeding and Foraging Habitats at Camas NWR

<table>
<tr><th rowspan="2">Habitat Type</th><th colspan="3">Use of Habitat by Focal Species</th></tr>
<tr><th>Breeding</th><th>Foraging</th><th>Other Benefitting Species</th></tr>
<tr><td rowspan="2">Hemi-Marsh

(50:50-Open water/Submerged aquatic: Deep Emergent-bulrush/cattail)</td><td colspan="2">Trumpeter swan
Eared grebe
Redhead
Muskrat</td><td rowspan="2">White-tailed deer (Winter)</td></tr>
<tr><td>Franklin’s gull
White-faced ibis</td><td>Cinnamon teal
Northern pintail
Northern shoveler
Lesser scaup
American white pelican
Peregrine falcon
Mink</td></tr>
<tr><td rowspan="2">Shallow Marsh</td><td colspan="2">Northern leopard frog</td><td rowspan="2">Northern leopard frog (Winter)</td></tr>
<tr><td>Sandhill crane</td><td>Cinnamon teal
White-faced ibis
Eared grebe
Northern pintail
Common snipe
Moose</td></tr>
<tr><td rowspan="2">Wet Meadow

(Sedges, rushes, grasses)</td><td colspan="2">Sandhill crane
American avocet</td><td rowspan="2"></td></tr>
<tr><td>Cinnamon teal
Northern shoveler
Common snipe</td><td>White-faced ibis
Long-billed curlew
Marbled godwit
Franklin’s gull</td></tr>
</table>

Table 4.4. Focal Species Comparison by Breeding and Foraging Habitats at Camas NWR

<table>
<tr><th rowspan="2">Habitat Type</th><th colspan="3">Use of Habitat by Focal Species</th></tr>
<tr><th>Breeding</th><th>Foraging</th><th>Other Benefitting Species</th></tr>
<tr><td></td><td></td><td>Short-eared owl
Western meadowlark</td><td></td></tr>
<tr><td rowspan="2">Dry Meadow

(Grasses, forbs)</td><td colspan="2">Long-billed curlew
Canada goose</td><td rowspan="2"></td></tr>
<tr><td>Lesser scaup
Western meadowlark
Short-eared owl
Sandhill crane</td><td>Franklin’s gull</td></tr>
<tr><td rowspan="2">Sagebrush Steppe

(Sagebrush, rabbitbrush, bitterbrush, bunchgrass, forbs)</td><td colspan="2">Greater sage-grouse
Sage thrasher
Loggerhead shrike
Sagebrush vole
Pygmy rabbit
Pronghorn antelope
Ground squirrel spp.</td><td rowspan="2"></td></tr>
<tr><td>Northern pintail
Long-billed curlew</td><td>Elk</td></tr>
<tr><td rowspan="2">Riparian

(Willow, grasses)</td><td colspan="2">Willow flycatcher
Yellow warbler</td><td rowspan="2">Greater sage-grouse(Brood and Winter)
Elk (Security Cover)</td></tr>
<tr><td></td><td>Greater sage-grouse
Elk
Moose</td></tr>
<tr><td rowspan="2">Shelterbelt

(Cottonwood, small trees, shrubs)</td><td colspan="2">Warbling vireo
Western wood-pewee
Downy woodpecker
American kestrel</td><td rowspan="2">Bald eagle (Winter roosting)</td></tr>
<tr><td></td><td>Yellow warbler
Olive-sided flycatcher</td></tr>
<tr><td>Agriculture

(Small grains, legumes, fallow)</td><td></td><td>Sandhill crane
Canada goose
Long-billed curlew
Elk
White-tailed deer</td><td>Greater sage-grouse (Brood rearing)</td></tr>
</table>

4.2.1 Analysis of Priority Resources of Concern

Wildlife and habitat goals and objectives were designed directly around the habitat requirements of species designated as priority resources of concern. 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 2009c).

In developing its listing of Priority Resources of Concern, the team selected not only species identified in refuge purposes and international, national, regional, State, or ecosystem conservation plans, but also species that captured the key ecological attributes of habitats required by larger suites of species. A key ecological attribute of an ROC is defined as:

> "A characteristic of the resource's biology, ecology, or physical environment that is so critical to the resource's persistence, in the face of both natural and human-caused disturbance, that its alteration beyond some critical range of variation will lead to the degradation or loss of the resource within decades or less." (Unnasch et al. 2009)

The team analyzed the key ecological attributes of habitats that are necessary 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 (see Appendix E). Key ecological attributes include habitat patch size; adjacency to or contiguity with other habitats; vegetation structure, species composition, age class, and seral stage; frequency and duration of flooding; and frequency and intensity of fire. These key ecological attributes provide measurable indicators that strongly correlate with the ability of a habitat to support a given species. For most attributes, the team developed "desired" conditions that were based partly on scientific literature review and partly on team professional judgment. These desired conditions for specific attributes were used to help design measurable habitat-based objectives, as presented in Chapter 2. Not all key ecological attributes or indicators were deemed ultimately feasible or necessary to design an objective around. In addition, while the key ecological attribute identifies a desired condition for most indicators, other factors, such as feasibility and the ability to reasonably influence or measure certain indicators, played a role in determining the ultimate parameters chosen for each objective. Thus the key ecological attributes should be viewed as a step in the planning process, but the ultimate design of objectives was subject to further discussion and consideration. Appendix E serves as a supporting appendix to Chapter 2.

The team analyzed limiting factors for the habitats that support the ROCs. 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 (see Appendix E). 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. For example pumps and water control structures may be used to control water levels in wetlands in areas where natural hydrology has been altered. The structure of plant communities used by ROCs can be created, rather than restoring native species composition. For example, haying may be used to maintain a desirable vegetation structure, when restoring native grassland communities may be impractical.

4.3 Habitat Types

A baseline inventory of Camas NWR habitats, including vegetation mapping, was completed in 2012 (Miewald et al. 2012). The effort resulted in characterization of sixteen plant communities (primarily mapped to the Alliance level) and four additional cover types (e.g., open water, nonvegetated, developed), based on analysis of aerial imagery combined with ground truthing. These are combined into five primary habitat types for the purposes of this analysis: Wetlands (including hemi-marsh, wet meadow, and open water); Willow Riparian and Scrub-shrub; Sagebrush-Steppe; Agriculture (including hay, alfalfa, and small grains); and Shelterbelt. Upland and Lowland Non-Native (also called ruderal) Vegetation are plant communities dominated by introduced non-native species. Historically these areas would have been represented by Sagebrush-Steppe/Dry Grassland, and Wet

Meadow communities, respectively. Map 3 (Chapter 2) shows current distribution of habitat types on Camas NWR. Table 4.5 below summarizes habitat and vegetation types on the Refuge.

Table 4.5. Habitat and Vegetation Types Of Camas NWR

CCP Habitat Type	Acres	% of Total Acres	U.S. National Vegetation Classification Type	Acres
Agricultural	328.2	3.05	Hay, Cooperative Farming (Alfalfa, Small Grain)*	328.2
Riparian (NWI riverine, palustrine scrub-shrub)	279.3	2.6	Narrow-Leaf Willow Shrubland Alliance	277.5
			Russian Olive Alliance*	1.8
Shelterbelt	33.9	0.32	Crack Willow Alliance	9.7
			Cultural Woody Vegetation*	33.9
Shrub Steppe	2,622.6	24.38	Intermountain Semi-Desert Grassland and Steppe Group	209.2
			Green Rabbitbrush Shrubland and Steppe Alliance	470.6
			Intermountain Dry Tall Sagebrush Shrubland and Steppe Group, Native	1,749.9
			Intermountain Dry Tall Sagebrush Shrubland and Steppe Group, Ruderal*	191.6
			Non-Vegetated (Intermountain Basins Cliff, Scree and Badland Sparse Vegetation)	1.4
Upland Non-Native	1,113.6	10.35	Crested Wheatgrass Ruderal Grassland Alliance*	983.9
			Great Basin and Intermountain Ruderal Dry Shrubland and Grass*	129.8
Wet Meadow (NWI Palustrine Emergent)	1,958.1	18.2	Baltic Rush Herbaceous Alliance	1,950.0
			Native Sedge Montane Wet Meadow Alliance	8.1
Lowland Non-Native	2,746.8	25.53	Western North American Ruderal Wet Meadow and Marsh Group*	2,746.8
Hemi-Marsh (NWI Palustrine Emergent, Palustrine Flooded)	841.0	7.82	Common Spike-Rush Herbaceous Alliance	256.9
			Hard-Stem Bull-Rush Herbaceous Alliance	485.1
			Broadleaf Cattail Herbaceous Alliance	51.6
			Senescent Vegetation Dominant (Litter)	37.7
Open Water (NWI Lacustrine, Riverine)	735.6	6.83	Amaranth Mudflat Sparse Herbaceous Alliance	256.8
			Open Water	439.0
			River Bottom Active Channel, Transitionally Vegetated	39.8
Developed	100.2	0.93	Developed	100.2

Table 4.5. Habitat and Vegetation Types Of Camas NWR

CCP Habitat Type	Acres	% of Total Acres	U.S. National Vegetation Classification Type	Acres
Total Acres	**10,759.3**	**100**		
Total Acres Native	**6,436.6**	**59.82%**		
Total Acres Non-native	**4,322.7**	**40.17%**		

Source: Miewald et al. 2012.
USNVC types are finest level mapped (Group, Alliance, Association).
* indicates non-native vegetation.

4.3.1 Wetlands and Deepwater Habitats

Overview

For the purposes of the CCP, wetlands are defined according to the classification system (Cowardin et al. 1979) used by the National Wetlands Inventory (NWI); however for the purposes of analysis here we exclude all riparian habitats which might be included under this classification, that is, those areas dominated by woody perennial shrubs or trees. These are discussed in Section 4.3.2, Willow Riparian and Scrub-Shrub. Cowardin et al. describe wetlands as “lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is covered by shallow water.” A positive indicator of wetland status requires the presence of one of the following:

- hydrophytic plants;
- hydric soils; or
- saturated or flooded soils during part of the growing season.

The key divisions of the NWI classification relevant to the Refuge include the lacustrine, palustrine, and riverine systems. *Lacustrine wetlands* are generally permanently flooded and are identified as those areas lacking trees, shrubs, or emergent vegetation with greater than 30 percent areal coverage and measuring greater than 20 acres. Smaller areas can be defined as lacustrine if the water depth in the deepest part of the basin exceeds 6.6-feet at low water. *Palustrine wetlands* may or may not be permanently flooded, but they are typically recognized by the presence of trees, shrubs, or herbaceous emergent vegetation. Under the NWI classification, Camas NWR shallow marsh includes the following palustrine types:

- Class = Emergent wetland (water regime modifier = semipermanently flooded)
- Class = Emergent wetland (water regime modifier = seasonally flooded)
- Class = Emergent wetland (water regime modifier = temporarily flooded)
- Class = Unconsolidated bottom (water regime modifier = temporarily flooded)
- Class = Unconsolidated bottom (water regime modifier = semipermanently flooded)
- Class = Unconsolidated shore (water regime modifier = seasonally flooded)
- Class = Open water (water regime modifier = semipermanently flooded)
- Class = Shrub scrub (water regime modifier = seasonally flooded) (Shrub-scrub is discussed in Section 4.3.2 below, “Riparian and Instream Habitat.”

Wetland plant communities tend to respond to the depth, duration, timing, and frequency of flooding (Fredrickson and Taylor 1982). Over time, these communities become well established and provide a snapshot of the type of hydrologic regime in place during the community development process. While other abiotic factors such as soil structure, groundwater movement, substrate texture, and water quality have some influence, hydroperiod is likely the primary formative factor in maintaining productive wetlands at Camas NWR.

Lacustrine (lake), palustrine (marsh) and riverine (stream) wetland systems are all represented in the Camas floodplain wetlands. As may be seen in Table 4.5, the majority of refuge wetlands are the palustrine type, along with small areas of lacustrine limnetic and littoral subsystems included within some of the deeper basins. Palustrine wetlands are characterized by a mix of wetland plant associations subject to a range of water regimes (temporary, seasonal, semipermanent and permanent). On the Refuge, semipermanent is the most common water regime, followed by seasonal and temporary, in that order. Permanent water regimes are the rarest among refuge wetlands, as would be expected in an arid environment. Within the palustrine system, the emergent vegetation class is the primary type encountered on the Refuge. All of the Refuge's active wetlands (see Refuge Management Activities section below for definition of active vs. inactive) are primarily palustrine emergent type, including the natural wet meadows and the hayed meadows. The inactive meadows are classified entirely as palustrine emergent vegetation.

In combination, the two primary components of palustrine emergent wetlands, *perennial emergent hemi-marsh* and *ephemeral wet meadow*, provide for the seasonal needs of all wetland-dependent resources of concern. Perennial emergent hemi-marsh and ephemeral wet meadow currently cover approximately 8 percent and 18 percent, respectively, of the Camas NWR habitat base (see Table 4.5 above).

Refuge wetlands total 6,561 acres, of which 24 percent (1,577 acres) is considered emergent and/or deepwater wetland habitat (hemi-marsh and open water, including mudflats); 72 percent (4,705 acres) are wet meadow-type wetlands; and 4 percent (279 acres) is riparian scrub-shrub (Table 4.5). It must be noted that more than half of the wet meadow habitat type (2,747 acres or 42 percent of total wetlands) is dominated by non-native vegetation (shown as "lowland non-native vegetation" in Chapter 2, Map 3) (Miewald et al. 2012). A detailed description of each wetland type is included in the following sections.

1. Perennial Emergent Hemi-Marsh can be defined as a roughly equal mix of emergent and open water/submergent habitat, and is critical to fulfilling the life history strategies of numerous wetland dependent wildlife species (Weller and Spatcher 1965). While the term is somewhat antiquated and rarely used today, a clear understanding of the general concept is essential to effective perennial emergent marsh management. The general premise is that overwater nesting waterbirds require habitat to fulfill two primary life history requirements during the breeding season; nesting and brood rearing. Nesting habitat (consisting of deep and shallow emergent vegetation) provides plant material necessary to construct floating or elevated nest structures, while brood rearing habitat (consisting of open water and submergent vegetation) provides the forage base for fledgling waterbirds. Maximum nesting densities are realized where the deep emergent marsh component retains a complex edge, relative to the open water component, and there is a 50:50 mix of these two components within any given management unit. Ideally, this optimal relationship would be realized through a large number of smaller open pools (1-25 acres) within emergent vegetation; however, at present, most refuge hemi-marsh habitat consists of a few large pools (>100 acres) ringed by emergent vegetation. Habitat types within the hemi-marsh system include:

(a) open water,
(b) submergent wetlands,
(c) deep emergent wetlands, and
(d) shallow emergent wetlands.

a) Open Water Habitat is defined as permanently flooded habitat greater than 12 inches in depth that is devoid of any aquatic vegetation. Open water habitat is vital to providing fish-eating birds such as white pelicans, western grebes, and Clark's grebes access to this food source. While not as essential as submerged habitat to a wide diversity of wetland dependent wildlife, it is important to maintain open water for a select few species which require this habitat for foraging. Open water wetlands also offer long sight distances and are free of mammalian predators. Therefore, they provide important loafing, resting, roosting and molting habitats for waterfowl.

Some deeper basins at Camas NWR, for example Sandhole Lake, contain open water year round, while other shallow basins dry out seasonally, creating mudflats. At Camas, 736 acres (6.8 percent of the Refuge) have been mapped as open water. Of this, 257 acres have been mapped as the "Amaranth mudflat sparse herbaceous alliance" (Miewald et al. 2012).

b) Submergent Habitat can be defined as permanently flooded habitat greater than 6 inches but less than 36 inches in depth, which consists of primarily aquatic submergent vegetation species such as pondweed, coontail, or water milfoil. Submergent habitat can be further subdivided into early and late producing submergent vegetation species such as pondweeds and muskgrass (*Chara*). Late successional submergent habitat consists of primarily leafy vegetation such as water milfoil, coontail, and mare's tail. Providing leafy browse for grazing species, seeds for granivorous species, and invertebrate resources for molting, nesting, and young waterbirds, submergent habitat provides a major food reserve within the hemi-marsh system.

Beds of submergent aquatic vegetation have been noted in the Refuge's open water habitat but have not been mapped separately to date, nor have surveys of aquatic vegetation been done. In the 2012 vegetation survey, submergent habitat was included under the Open Water habitat type (Miewald et al. 2012).

Submergent habitat provides the desirable open water condition in palustrine emergent marsh wetlands. The desired condition is approximately 50 percent submergent habitat in open water areas, while maintaining a minimum of 5 percent of the refuge area as this habitat type. Within successional stages, it would be desirable to maintain between 60 to 80 percent of submergent habitat in early successional seed producing vegetation, while maintaining 20 to 40 percent of submergent habitat in a late successional stage consisting of leafy browse-dominant vegetation.

c) Deep Emergent Habitat can be defined as semipermanently flooded habitat consisting primarily of hardstem bulrush, but also containing cattail. Emergent vegetation at varying levels of residual coverage provides nesting habitat and cover for a variety of wetland dependent wildlife species. Emergent vegetation forms the "housing" component of the hemi-marsh environment, including overwater nesting sites for wetland dependent bird species; invertebrate substrate for foraging waterbirds; lodge materials and loafing sites for aquatic mammals, and shade and cover for all species.

Similar to submergent habitats, deep emergent habitat can be further subdivided into three successional stages: early successional (deep emergent habitat consisting of less than 30 percent residual vegetation coverage from previous year's growth), mid successional (deep emergent habitat consisting of 30-90 percent residual vegetation coverage), and late successional (deep emergent habitat consisting of over 90 percent residual vegetation coverage). Different levels of residual vegetation are desirable to different resources of concern based on seasonal life history requirements.

Early successional deep emergent habitat is a direct result of prescribed fire and typically lasts less than two years following a burn. Mid successional deep emergent habitat is found in areas burned between three to seven years prior. Late successional deep emergent habitat typically occurs more than seven years following disturbance (mechanical or prescribed fire). The desired condition is to maintain between 10 percent and 20 percent of refuge deep emergent habitat in an early successional seral stage (<30 percent residual cover), between 60 percent and 80 percent in a mid-successional stage (30-90 percent residual cover), and between 10 percent and 20 percent of refuge deep emergent habitat in a late successional stage (>90 percent residual cover).

d) Shallow Emergent Habitat is defined as semipermanently to ephemerally flooded habitat consisting primarily of hardstem bulrush, but also containing shallowly flooded cattail and alkali bulrush, typically flooded to a depth of 3 to 24 inches. The primary difference between deep and shallow emergent habitat is water permanence. Shallow emergent habitats are occasionally dewatered during summer months, while deep emergent habitats are permanently wet. Additionally, this habitat type contains plant species such as alkali bulrush and annual plants which provide additional food reserves for wildlife within the hemi-marsh complex. While deep emergent vegetation forms the concentric ring around open water/submergent habitats, shallow emergent vegetation provides the interface with the ephemeral wet meadow zone. As such, the shallow emergent zone functions similarly to the deep emergent zone for wetland dependent wildlife species that require wet meadow and adjacent uplands to fulfill their life history strategies.

Together, deep and shallow emergent wetlands cover approximately 840 acres or 7.8 percent of the Refuge (Miewald et al. 2012).

2. Ephemeral Marsh is the palustrine emergent marsh component that is subject to an ephemeral hydrologic regime. Water depths range from moist soil during late summer to as much as two feet during spring. It is this seasonal fluctuation that produces and then concentrates food reserves for most wetland-dependent wildlife species. The diversity and complexity of plant species within ephemeral marsh habitats provides ideal substrate for invertebrates, which constitute 90 percent of most waterbird diets during summer months. With fall flooding during migration, the seeds produced by annual plants additionally provide forage for migratory waterbirds. Ephemeral marsh consists of two habitat types including (a) wet meadow and (b) alkaline meadow, either of which can be treated as moist-soil habitat with the appropriate water management strategy.

a) Wet Meadow is defined as ephemeral to semipermanently flooded marsh dominated by low stature, flood tolerant, annual, and perennial plants. Typical species include spikerush, Baltic rush, and flood tolerant grasses such as foxtail barley, saltgrass, and rabbitfoot grass. Approximately 1,950 acres, or 18.2 percent of the Refuge, is the native Baltic Rush Herbaceous Alliance. Only 8 acres are Native Sedge Montane Wet Meadow Alliance. While native, Baltic rush becomes more dominant in grazed areas (Kittel et al. 2012). Past grazing practices probably contributed to the prevalence of Baltic rush in the Refuge's wet meadow communities. The most extensive vegetation group on the Refuge is the non-native Western North American Ruderal Wet Meadow and Marsh Group, which occupies 2,747 acres or more than 25 percent of the Refuge. Historically, this was likely native wet meadow habitat (Miewald et al. 2012).

Wet meadow habitats can be further subdivided by successional stage. Early successional status includes wet meadow habitat where less than 20 percent of the community contains dense residual cover, whereas late successional status is defined as wet meadow habitat where greater than 90 percent of the community contains dense residual cover and/or greater than 20 percent of the community is forb dominant. The desired condition is less than 60 percent of wet meadow in the early successional stage and a minimum of 20 percent to 40 percent coverage in the late successional stage. Only 150 acres of Camas wet meadow is hayed annually; see section 4.3.4 below, Agriculture. Therefore in terms of successional status, the wet meadows at Camas meet this desired condition.

The majority of meadow-type wetlands, especially the more mesic sites, were considered "wild hay" (native grasses that were hayed annually) before refuge establishment. Although some native herbs and grasses survive, much of the hayland meadows have been converted to "tame" species, such as quack grass, smooth brome and alfalfa. Management of hay units are described in section 4.3.4 below. Approximately 330 acres of areas previously farmed in small grain were allowed to go fallow in the mid-1970s when refuge grain production was scaled back. Consequently non-native grasses (quackgrass, smooth brome) became established in these areas.

Table 4.6. Key Ecological Attributes, Indicators, and Condition Parameters for Wetlands

Habitat Type	Key Attributes	Indicators/ Desired Conditions
All wetland types	Hydrology	Natural hydrologic cycles to stimulate vegetation succession, soil desiccation and nutrient recycling. Annual spring floods with gradual summer to fall drawdowns so that approximately 33% of the Refuge is in natural or simulated drought, normal or flood conditions. Different units would be managed in rotation so that any unit would cycle through drought, normal and flood conditions.
	Hydroperiod	Maintain sufficient water in all wetland habitat types to fulfill natural ecological processes and meet life history needs of wetland dependent wildlife.
	Vegetation	100% native emergent and submergent species.
	Patch Size	Sufficient to ensure normal ecological function and to meet life history needs of all wetland dependent wildlife.
	Invertebrates	Diverse and abundant populations of native terrestrial and aquatic invertebrates. Population size, density and distributions sufficient to maintain self-sustaining viable populations, provide forage for all insectivorous wildlife, and perform necessary ecological functions such as herbivory, predation and pollination.
	Invasive Species	Few to none. <10% thistles, *Phragmites* and other wetland invasive plants; few to no carp or other non-native fish.
Palustrine emergent hemi-marsh	Structure	Complex edge of open water component; 50:50 mix of open water and emergent vegetation within each management unit. Large number of small open pools (1-15 ac) within emergent veg. (At present most refuge hemi-marsh consists of a few large pools ringed by emergent vegetation.)
Open Water	Water Depth/ Quality	100% coverage of high clarity open water, greater than 12 inches deep in impounded wetland units

Table 4.6. Key Ecological Attributes, Indicators, and Condition Parameters for Wetlands

Habitat Type	Key Attributes	Indicators/ Desired Conditions
Submergent aquatic vegetation	Vegetation	Aquatic submerged veg (e.g., pondweed, coontail, water milfoil) 60-80% early successional seed producing veg 20-40% late successional leafy browse veg
	Water Regime/ Depth	Permanently flooded, 6-36 inches deep
Deep emergent habitat	Vegetation	Tall emergent vegetation, primarily hardstem bulrush, cattail. 10% to 20% in early seral stage (<30% residual cover), 60% to 80% in mid seral stage (30%-90% res cover), 10% to 20% in late seral stage (>90% res cover)
	Water Regime Depth	Semipermanently to ephemerally flooded 3-24" deep
Shallow emergent habitat	Vegetation	Hardstem bulrush, shallowly flooded cattail, alkali bulrush
	Water Regime, Depth	Semipermanently to ephemerally flooded
Ephemeral marsh	Vegetation	Emergent vegetation, e.g., rushes, sedges.
	Water Regime/ Depth	Ephemerally flooded, moist soil during late summer to ≤24 inches in spring
Wet meadow	Vegetation	Low stature, flood tolerant, annual and perennial plants, e.g., spikerush, Baltic rush, foxtail barley, saltgrass, and foxtail grass. ≤60% in early seral stage and ≥20%-40% in late seral stage
	Water Regime/ Depth	Ephemerally to semipermanently flooded

Table 4.7. Key Ecological Attributes, Indicators, and Condition Parameters for Waterfowl—Wetlands

Key Ecological Attributes	Indicators	Desired Conditions
Hydrology/hydroperiod	Variable depth over space and time; intra- and inter-annual variation as determined by surface and groundwater availability.	Applied surface water in different areas according to Camas Creek flows.
Vegetation diversity and structure	Rotating hemi-marsh conditions; wide abundance and diversity of submerged aquatic vegetation	Sago pondweed and other Potamogetons; ≤50% surface area moderately dense (≤50 stems/m^2) emergent vegetation (e.g., bulrush, cattail) for nesting and brood cover
Forage	Abundant and diverse submerged aquatic vegetation; abundant and diverse invertebrate populations.	Sago and other Potamogetons; Myriophyllum; Ceratophyllum; gastropods; chironomids; amphipods; etc. determined by site and hydroperiod.
Invasive species	Few to no invasive plants or animals present	No carp, Eurasian milfoil, thistles, etc.
Human use	None to much, depending on location and season	No disturbance during breeding (courtship through brood rearing); localized and high disturbance during legal hunting seasons to freeze-up, with sanctuary provided.

Table 4.8. Key Ecological Attributes, Indicators, and Condition Parameters for Colonial Waterbirds—Wetlands

Key Ecological Attributes	Indicators	Desired Conditions
Hydrology/hydroperiod	Variable depths over space and time within each refuge unit, by specific impoundment.	Maintain stable breeding conditions for large colonial nesting concentrations; approximately 1-foot water elevation in historic colonial nesting waterbird colony sites. Maintain approximate 50:50 interspersion of perennially flooded hemi-marsh for overwater and upland nesting waterbirds. Maintain submergent vegetation for post breeding forage. Reflood annual plants produced by summer drawdown for fall migratory waterfowl use.
Vegetation diversity and structure	Rotating temporary, seasonal, and structure. Semipermanent and permanent wetlands containing a wide abundance and diversity of submerged and emergent vegetation.	Moderately dense to dense ($\leq$50 stems/m^2) emergent vegetation (e.g., bulrush, cattail) for nesting and brood cover
Forage	Abundant and diverse submerged aquatic vegetation hosting abundant and diverse macro-and micro-invertebrate populations.	A variety of native submerged aquatic plants, hosting diverse and abundant invertebrates (i.e., coleoptera, gastropods; chironomids; amphipods; etc.) determined by site and hydroperiod.
Invasive species	Few to no invasive plants or animals present	No carp, Eurasian milfoil, thistles, etc.
Human use	None to much, depending on location and season	Except for required research or monitoring, no disturbance during breeding (courtship through brood-rearing); localized and high disturbance during legal hunting seasons to freeze-up permitted since these species can use other areas.

Regional Distribution, Conditions, and Trends of Wetlands

In Idaho an estimated 386,000 acres of wetland habitat (56 percent) were lost from 1780 to 1980 (Dahl 1990). Many remaining wetlands have been degraded by actions such as hydrologic alteration and impacts to vegetation and soils. Wetlands, including deepwater habitat, cover approximately 34,766 ha (85,909 acres) of southeastern Idaho’s Upper Snake River watershed (Kittel et al. 2012). Most of these wetland occur in mid to upper elevations in the watershed (27 percent is subalpine/montane riparian in upper elevations and 50 percent is foothill and lower montane riparian woodland and shrubland). Thirteen percent is open water (primarily the American Falls Reservoir). Low elevation wetlands account for only 4 percent of wetlands in the watershed (1,296 ha/3,202 acres of floodplain and 116 ha/287 acres of emergent marsh). Wetlands cover 2,325 ha (5,745 acres) of the Beaver-Camas watershed; 82 percent is mid to upper elevation riparian. Eight percent

(193 ha/477 acres) is open water (mostly Mud Lake) and only 190 ha/470 acres (8 percent) is floodplain and emergent marsh habitat.

The Ecological Integrity Assessment for Camas NWR (Kittel et al. 2012) concluded that lower elevation riparian and marsh areas are in the poorest condition relative to other wetland types in both the Upper Snake River and Beaver-Camas watersheds, with high impacts from development. In the Beaver-Camas watershed, emergent wetlands had a condition ranking of 37/100 (Low Condition) and lowland riparian and floodplain had condition ranks of 61/100 and 66/100 respectively (Moderate). (These scores do not reflect cumulative loss of wetland habitat, only condition of existing habitat). The EIA also concluded that Camas NWR has some of the best condition low elevation wetlands within the local Beaver-Camas watershed. Camas NWR also has some of the best base-of-the-foothills positioned wetlands in the entire Upper Snake River Watershed, especially along the northern edge of the Snake River Plain. The location of Camas' wetland and riparian areas within a landscape that has largely been converted to intensive production agriculture, as well as its position within an interior arm of the Pacific Flyway, make it strategically important for supporting wildlife movement and long-term conservation of wetland-dependent species.

Condition and trends of Camas NWR wetlands. A significant portion of the existing wetlands at Camas NWR have intensive anthropogenic influences. Many of the present ponds are completely manmade and artificial. Others, including numerous meadow and hayfield wetlands, have been extensively modified by human activity. Construction of numerous impoundments with water control structures allowed managers to partition and manage discrete water bodies for specific goals and objectives, based on hydrology, soils, vegetation, and other ecological factors, but this management was dependent on adequate water. However, proper water management is difficult in this complex system, and requires considerable skill in monitoring and interpreting conditions at any given place or time. It is imperative to have new management guidelines that will allow managers to factor in current conditions while still striving to maintain wetland habitat goals.

In the absence of adequate water to hydrate wetlands, invasive plants easily gain a foothold. The 2011 vegetation survey of the Refuge (Miewald et al. 2012) showed that approximately 40 percent of Camas NWR (including approximately one-third of upland plant communities and half of lowland, for instance, wetland plant communities) are "ruderal," that is, constituted primarily of non-native species, such that reconstructing the original vegetative community of the area is difficult. By extension, these non-native, undesirable plant communities can be expected to continue to increase. Managers must be extremely cautious of any activities in, or near, those sites that would provide opportunities for, or accelerate the rate of, weed expansion.

Kittel et al. (2012) ranked the ecological integrity of both wetland and upland sites at Camas NWR (127 sites covering 252 acres/102 ha). Ninety-three wetland sites and 34 upland sites were assessed. Metrics for assessing ecological integrity of wetland sites included relative cover or native and non-native plant species, vegetation composition (species composition and diversity), soil surface condition, and patch diversity. An EIA score of 1 is a highly altered ecosystem that has a high level of stress, little buffer or resistance capacity, and may not recover from continued application of stressors. An EIA score of 5 represents reference conditions in a completely undisturbed state. In addition, ecological integrity of the Refuge's wetland complexes were also assessed using remote sensing with GIS with field verification. Metrics for wetland complexes included surrounding land uses, landscape and hydrologic connectivity, buffer indices, and absolute and relative size.

For the 93 wetland samples, one third of the plots ranked excellent to good integrity (EIA score A-B, 3.1-5.0), while the remaining two thirds ranked fair to poor integrity (EIA score C-D, 1.0-3.0) (Table 4.9). Soils showed very little direct physical damage, no soil compaction, excessive erosion, or off-road vehicle damage. Lower scores at Camas NWR are largely due to the abundance of non-native invasive plant species. Some areas have completely transformed into ruderal types (areas that are dominated entirely by non-native species and are now beyond the natural variation of the native vegetation community once present).

Looking at the ecological integrity scores summarized by their vegetation classification by the US NVC Group type, we can tease out the condition of remaining native, non-ruderal habitats. The Freshwater Marsh Group (US NVC G518 Western North American Temperate Interior Freshwater Marsh Group, 19 sites) consists of emergent wetland vegetation dominated by tall species such as hardstem bulrush (*Schenoplectus acutus*) and cattails (*Typha latifolia*), or the much shorter spikerush (*Eleocharis palustris*). These wetlands remain saturated or with standing water for much of the growing season and are therefore often nearly devoid of invasive weed species. About half of the Freshwater Marsh areas sampled were in excellent condition (47 percent), 21 percent in good condition, 21 percent in Fair condition, and 11 percent in Poor condition. Poor condition sites were often located at the drier fringes of the wetland where invasive weeds can more easily gain a foothold.

As the sites with the most transient water regimes, wet meadows are particularly vulnerable to invasion by non-native plants. The Wet Meadow Group (USNVC G521 Vancouverian and Rocky Mountain Montane Wet Meadow Group) was sampled 28 times. Twelve percent of sites were in excellent condition, 17 percent were in good condition, about half of the areas were in fair condition, and one quarter were in poor condition. In the NRCS state and transition vegetative succession models, there are two community states for wet meadow sites, where either sedge (Nebraska, *Carex nebrascensis*, or beaked, *Carex rostrata*) and Baltic rush (*Juncus balticus*) are dominant (Germino et al. 2010). Stringham (2003) defines a "state" as "a recognizable, resistant and resilient complex of two components, the soil base and the vegetation structure." The expected natural dominant plant species of these sites, in the admittedly subjective rating of "healthy" condition, should be sedge and rush. The NRCS technical guide notes the wet meadow site will transition to an altered state with lowering of the 10-20 inch reference water table. The dominant plants and other plant species within the wet meadow community change as the site shifts to different successional sites. The water table at Camas NWR has receded far below the 10-20 inch zone.

Kittel et al. found more examples of poor condition Baltic Rush (*Juncus balticus*) Alliance than the montane sedge alliance; however few Montane Sedge Wet Meadow Alliance sites were sampled (three sites). The Baltic Rush Alliance had more samples where non-native quack grass (*Agropyron repens*) was co-dominant, whereas the montane sedge meadow alliance had stands where non-native species were less abundant. The Ruderal Wet Meadow and Marsh Group is by definition dominated by non-native invasive species and the assumption in applying EIA ranking criteria is that these areas were once the native wet meadow type that has now been completely transformed into a novel ruderal type. The EIA score of "D" or poor, is consistent with the classification of these areas, i.e., they are no longer functioning as (and are outside the natural range of variation of) their native counterparts. Additional sample points from freshwater and alkaline flats showed a similar trend with 20 percent in good condition and 80 percent in fair to poor condition.

These results confirm the findings of Germino et al. (2010). They found that of 23 Camas wet meadow transects, Baltic rush was above 35 percent coverage of ground area in only three transects

(13 percent), and was above 10 percent coverage in five more transects (22 percent). The other dominant plant type in reference sites, sedges, were only found above 10 percent on three transects (13 percent).

Germino's work further characterizes the wet meadow sites as follows: "The cover of all transect points combined in wet meadows was 24% quackgrass; 16% Baltic rush, 11% tufted hairgrass, 6.6% western wheatgrass, 4% each of pennycress, smooth brome, and Devil weed; 3% spikerush, about 1-2% each of scirpus bulrush, sisymbrium, cheatgrass, rabbitbrush, Canadian thistle, wild licorice, prickly lettuce, poverty weed, and kochia." Obviously, the conditions of the hay meadows and the unmodified portions, or balance, of the wet meadow ecological sites have greatly departed from the expected natural condition. Germino concluded, "Much of the habitat classified as wet meadow at Camas NWR appears to be in the transition from state 2 to 3, or it is in an undescribed state that does not resemble typical wet meadows and instead has early-successional and exotic weedy species of upland habitats."

Wetland Complex Ecological Integrity Analysis.

Big Pond Wetland Complex (Map 12) includes Big Pond, Spring Pond, Flat Pond, Goose Pond, and Brindley Pond. Component metric scores included some excellent and poor rating scores for a total Ecological Integrity Assessment score of 3.3, "B-" or fair/good. The Landscape context is very good, since the complex is mostly surrounded by other wetlands, natural vegetative cover, and only a small amount of irrigated agriculture (score "A"). The immediate buffer area surrounding the wetland contains a 15-20-meter (m)-wide (49-66-feet-wide) dirt road on a raised dike that nearly surrounds the wetland, while the rest is native or weedy vegetation (Buffer Index score "D"). The total Landscape score is a "C" (Fair).

The size of Big Pond Complex is relatively large for this type of wetland (score "A"), but the loss of an artesian well due to a drop in the groundwater table has reduced the historic extent of this wetland area, giving a relative size score "B." The total Size score still averaged out to an "A," (excellent).

The Big Pond Complex has areas of entirely native vegetation (emergent marshes of bulrush and cattail and native wet meadows of Baltic rush). One field site at Big Pond received an "excellent" score for vegetation condition. However the complex also contains large areas of non-native invasive weeds, which have transformed formerly native wet meadows into ruderal vegetation (for example, Flat Pond), likely due to the loss of groundwater upwelling in the northeast corner of the wetland. The average condition of the vegetation in six field-based sites is a "C" (fair). The hydrology metrics are scored as good, since the refuge is actively replacing lost groundwater upwelling with pumped water, and the hydroperiod as managed may be replacing the historic pattern of high spring flows and late fall drawn downs. In addition, the water management allows for hydrologic connectivity between the Big Pond and Center Pond wetland complexes. The total Hydrology Score is "B" (good). Current soil surface conditions appear excellent with little compaction, erosion, damage or off-road vehicle use: score "A." However the physical patch type or patch diversity has been altered; the ponds are deeper and there is more open water than was historically present (score "C"). The total Condition score combines the vegetation condition, hydrology condition and soils condition which averages out to a "B" or good score. The overall Ecological Integrity Assessment score for Big Pond Wetland Complex is 3.3, "B-" or fair/good.

Center Pond Wetland Complex includes most of the Refuge's "core" wetlands and consists of Center Pond, Two-way Pond, Toomey Pond, Redhead Pond and Rat Farm Pond. Component metric scores included some excellent and poor rating scores for a total Ecological Integrity Assessment score of 3.1, “C” or fair. Since the Center Pond Complex is located in the heart of Camas NWR, the surrounding area beyond the wetland buffer to 500 m (1,640 feet) is nearly all natural land cover with little human influence, scoring “A” (excellent) for both landscape continuity and land use. However, the immediate wetland buffer is not natural; 15-20-m-wide (49-66-feet-wide) dirt roads on raised berms nearly surround the wetland. The limited area with a natural buffer has mostly non-native weedy vegetation, so the Buffer Index score is “D.” The combined Landscape Context (Buffer Index, Land Use, and Landscape Connectivity) score is “C.”

The size of the Center Pond Complex is typical and relatively large for this type of wetland (score “A”), but the loss of an artesian well due to a drop in the groundwater table has reduced the historic extent of this wetland area, giving a relative size score “B.” The total Size score still averaged out to an “A” (excellent).

As with the Big Pond Complex, Center Pond has areas of entirely native emergent marshes of bulrush, cattail and spike rush (e.g., Toomey, portions of Center, and Two-Way Ponds) and native wet meadows of Baltic rush and native sedges. However, it also contains large areas of former wet meadows that are now dominated by non-native invasive weeds (e.g., the northeast portion of the Complex, and Rat Farm Pond) likely due to the loss of groundwater upwelling. The average vegetation condition of sixteen field based sites is a “D” or poor rating. As with the Big Pond Complex, the hydrology scores are good, since the lost groundwater upwelling is being replaced with pumped water, and the managed hydroperiod may simulate the historic pattern. In addition, the water management allows for hydrologic connectivity between Center Pond and other wetland complexes. The total Hydrology Score is “B” (good). Current soil surface conditions appear excellent with little compaction, erosion, damage or off-road vehicle use: score “A.” However the physical patch type or Patch diversity has been altered; the ponds are deeper and there is more open water than was historically present (score “C”). The total Condition score combines the vegetation condition, hydrology condition and soils condition, and averages out to a “B,” (good). The overall Ecological Integrity Assessment score for Big Pond Wetland Complex is 3.3, “B-” or fair/good.

The Rays Lake Wetland Complex includes Rays Lake, Sandhole Lake, Mallard Slough and Cattail Flat, and Avocet Pond. Cattail Flat is adjacent to Camas Creek and was part of its historic floodplain. Component scores included some excellent and poor scores, for a total Ecological Integrity Assessment score of 3.1, “C” or fair. Rays Lake Complex is surrounded by wetland and upland habitats with little human footprint within 500 m (1,640 feet), scoring “A” (excellent) for both landscape continuity and land use. About half of the immediate wetland buffer is composed of 15-20-m-wide (49-66-feet-wide) dirt roads on raised berms. The rest of the buffer has mostly non-native weedy vegetation, so the Buffer Index score is “D.” The combined Landscape Context (Buffer Index, Land Use and Landscape Connectivity) score is “C.”

The size of Rays Lake Wetland Complex is typical and relatively large for this type of wetland (score “A”), but the loss of both Camas Creek inflows and artesian wells due to a drop in the groundwater table has reduced the historic extent of this wetland area, giving a relative size score of “B.” The total Size score still averaged out to an “A” (excellent).

Rays Lake has areas of entirely native emergent marshes of bulrush, cattail and spike rush, and native wet meadows of Baltic rush and native sedges (e.g., Sandhole Lake and portions of Rays Lake). However there are large areas of non-native invasive weeds (e.g., portions of Cattail Flat and Mallard Slough) that have transformed formerly native wet meadows into ruderal vegetation; again, likely due to the loss of groundwater upwelling. The average score for vegetation condition of the 32 field based sites is “C” (fair). The hydrology score is good, since the lost groundwater upwelling is being replaced with pumped water, and the managed hydroperiod may simulate the historic pattern of high spring flows with late fall drawn downs. In addition, the water management allows for hydrologic connectivity between Rays Lake, Camas Creek, and other wetland complexes. The total Hydrology Score is “B” (good). Current soil surface conditions appear to be fair, with some areas of compaction, erosion, damage, or off-road vehicle use: score “C.” However the physical patch type or patch diversity shows what appears to be a natural gradient between shallow marsh and uplands. The patch diversity appears to be a near historic pattern for this type of wetland complex, for a score of “A.” The total Condition score combines the vegetation condition, hydrology condition and soils condition, which averages out to a “B” or good score. The overall Ecological Integrity Assessment score for Rays Lake Wetland Complex is 3.3, “B-” or fair/good.

Threats to Wetlands

The main threat to the wetlands of Camas NWR, of all types, whether natural, or modified, is the reduction in available water. Both climatic and anthropogenic causes of that loss are equally serious, although the relative contributions of each cause shift through time as various impacts increase or subside. Losses of atmospheric moisture, surface flows, or groundwater have combined to degrade the lacustrine, palustrine, and riverine systems of the Camas Creek floodplain, both on- and off-Refuge. The lowering of the aquifer through both a drying climate, agricultural pumping and, perhaps, environmental warming, has probably been the most pervasive negative impact to wetland condition on Camas NWR and surrounding lands. Allied influences, such as incision of the Camas Creek streambed, as well as other drainages, through erosion and channelization, or cleaning activities, magnify the effect of lower total water availability.

The future prospects offer no apparent relief from these hydrologic stressors. Population growth and water demand in the region are projected to increase at greater intrinsic rates than historically. Regional climate models indicate a warming climate with decreasing snowpack in upper elevations of watersheds (see Chapter 3). Given these projections of both decreased water availability and increased demand, the obvious management model would appear to be a “rear guard” action of slowing the inevitable, continuing degradation of refuge wetland conditions and the actual loss of wetland acres. As noted above, type conversion of plant communities (e.g., from wetland to upland types) has already begun, and invasive species constitute much of those new plant communities in the Camas NWR wetlands (Germino et al. 2010; Miewald et al. 2012).

Key Species Supported

Birds

All told, the refuge hosts at least 177 species of birds, including 32 species of waterbirds (e.g., loons, grebes, bitterns, terns, gulls, ibis, cranes), 26 species of waterfowl (swans, geese and ducks), 23 raptors, and over 65 species of passerine birds. At least 83 species breed on the Refuge. Many of these use the Refuge’s wetland habitats for foraging, nesting, and brood rearing. Healthy and productive refuge palustrine wetlands host a rich diversity of emergent wetland plants including smartweeds, bulrushes, sedges, rushes, bur-reed, and cattail. Additionally, submergent plants such as pondweeds, and floating aquatic plants such as duckweed, are valuable waterfowl food resources produced within palustrine wetlands. Waterfowl may consume entire plants, or selectively consume portions of plants including seeds, tubers, rhizomes, and roots. The detritus and submerged microhabitats formed by seasonally flooded, emergent vegetation create an important substrate for the production of aquatic invertebrates. Consumption of invertebrates provides fat and protein that is seasonally significant to female ducks for egg development and laying (Baldassarre and Bolen 2006).

With an interspersion of deep water (up to 5 feet) and tall emergent vegetation, a long period of inundation (generally March-October), and a diverse forage base (e.g., aquatic plants and invertebrates), refuge hemi-marsh habitat provides both breeding and foraging habitat for a variety of species. Most notably these include trumpeter swans (breeding and foraging), diving ducks (e.g., redhead and lesser scaup), dabbling ducks (cinnamon teal, northern pintail, and shoveler), grebes, and colonial nesting waterbirds (Franklin's gull, white-faced ibis). Colonial nesting has been in a long-term decline on the Refuge, and currently occurs sporadically, based on water and vegetation conditions.

Shallow (seasonal) marshes provide breeding habitat for greater sandhill cranes, as well as foraging habitat for American avocets, cinnamon teal, sora, Virginia rail, white-faced ibis, eared grebe, northern pintail, and common snipe. The Refuge's wet meadows are important breeding habitat for sandhill cranes, cinnamon teal, northern shoveler, common snipe, and American avocet. They provide foraging habitat for a variety of species including sandhill crane, American avocet, white-faced ibis, long-billed curlew, marbled godwit, Franklin's gull, short-eared owl, and western meadowlark.

Mammals, Reptiles and Amphibians, and Fish

This habitat also supports muskrats (although populations are probably much reduced from levels present several decades ago). Hemi-marsh also provides cover and forage for white-tailed deer in winter. Carnivores (e.g., coyote, raccoon, striped skunk, mink, long-tailed weasel), use wetlands opportunistically. The small mammal community is not well-documented.

Reptiles and amphibians known to occur in wetland habitat are western terrestrial and “common” garter snakes, western chorus frogs, and northern leopard frogs. Shallow seasonal wetlands provide breeding, foraging and wintering (hibernation) habitat for northern leopard frogs. Other species undoubtedly occur, but there are no formal inventories. Native or introduced fish do not exist on Camas NWR at present, other than native minnows (e.g., Utah chub) in Sandhole Lake and possibly in the most persistent pools in various ditches and stream courses.

There are no known checklists of any invertebrate species on Camas NWR. Since these species have important ecological roles, these data are badly needed to ensure that any habitat management takes species life histories into account.

Refuge Management Activities

Water Management

The general management philosophy to date has been to maintain hydrologic regimes that maximize permanent water for migratory and breeding waterfowl and waterbirds. Currently, the management focus of the Refuge is to use the available water to provide the minimum amount of palustrine emergent marsh sufficient to allow waterbirds and other wildlife to successfully complete their life history requirements during the time they are present. This is difficult given that annual water supplies are not very predictable, and that the current system of impoundments was not designed to move often very limited amounts of water throughout the entire system. Because of highly variable annual flows, the extent and distribution of habitat that is actively managed is also highly variable within and between years.

Following natural environmental fluctuations of flood or drought, overall historic wetland levels in the area now occupied by Camas NWR may have fluctuated from basin-wide coverage in flood years, to only a few wetland acres during drought periods. These processes were important in developing the wetland habitats that exist on the Refuge today, but the historic hydrologic periodicity has been dramatically altered, as previously described, by both climatic variation and anthropogenic influences throughout the watershed.

Annual fluctuations in Camas Creek, and rarely in Beaver and Warm creeks, resulting in out-of-bank flow, provide desirable hydrologic periodicity outside of the irrigation season. Such events, where flows exceed channel capacity, are rare and unpredictable, and are currently a remote potential only during high moisture years (approximately one out of every six years). During the regular irrigation season, spring flows subside rapidly, depleting wetland acreage at the time when waterbirds need it most. Today, with a dropping water table and raised banks of Camas Creek that prevent overland flooding, water must be diverted from Camas Creek to help sustain and recharge the wetlands of Camas NWR. Refuge water rights are generally used to hydrate wetlands for wildlife needs and irrigate hay fields during summer months. The management intent is to at least partially replicate the area's natural hydrology by direct use of water rights to simulate natural flood periods. A possible ancillary benefit to this management practice is limited groundwater discharge from Refuge wetlands back into the aquifer. In the 1950s and 1960s the managers of Camas NWR began to augment surface water flows from Camas Creek with the use of groundwater pumping to have more control of water levels and placement throughout the calendar year.

Some of the seasonal water allocation is used to supplement overbank flow, as well as recharge meadows adjacent to the creek channels (historically meadows were recharged by instream flow, but this normally no longer occurs).Refuge management needs to simulate natural environmental processes, particularly hydrologic periodicity, while retaining as much wetland acreage as possible on an annual basis. The existing infrastructure was not developed for that purpose and is not capable of rotating wetlands between normal, flood, and drought simulations based on the condition of the habitat in a given year. The infrastructure was designed to hold as much water as possible, every year. This applies to all "modified" refuge wetlands, that is, those that have been mechanically altered with dikes and water delivery systems, including wells and pumps.

The infrastructure allows for independent water management within individual wetland units, in some cases, but in others water cannot be moved without first filling, or draining, a nontarget wetland. The modified refuge wetlands are a mosaic of both wetland management complexes (see "Wetland Management Units," page 45 below), where water cannot generally be moved to, or from, specific impoundments without affecting others; and "stand-alone" units with their own water delivery systems. The design of the existing wetland system reflects the waterfowl management philosophy that was in force at the time of refuge establishment, and for many years thereafter: trying to develop the most permanent water possible on the largest acreage available.

Today, management philosophy has shifted toward emulating natural hydrologic periodicity to maintain wetland health and provide the best long-term wetland habitat possible. At the crudest management level, periodic fluctuations, including complete drawdown and wetland bottom drying and aeration, are now highly desirable objectives. It would be desirable to mimic historic natural processes of flooding and drying to maintain wetland function. Because the natural hydrologic regime in the Camas Creek floodplain has been altered through development of groundwater based irrigation systems upstream, it is no longer possible to maintain these natural processes. However, using the water that is available, it is possible to mimic natural environmental fluctuations, at least periodically. Using rotation among wetlands, it is possible to simulate three scenarios (flood, normal cycle, and drought) between years. This is proposed on the Preferred Alternative of this CCP (see Chapter 2).

A few of the Refuge's wetlands allow for independent simulation of natural environmental processes to promote a mix of habitat types. By providing a mix of these habitat types in close juxtaposition, a variety of habitats in various successional stages can be provided to meet a wide diversity of wetland dependent wildlife demands. Rotation of simulations within wetlands maintains overall marsh health by setting back succession to prevent units from becoming dense decadent stands of emergent vegetation.

Appropriate water depths are important for effective waterfowl management. Geese frequently forage in shallow wet meadow conditions or sheet water conditions with less than six inches of water. Management of seasonal wetlands is valuable for producing emergent wetland vegetation that is a primary food resource for breeding and migrating waterfowl. Water depths of 2-10 inches are optimal for foraging by dabblers, allowing them access to invertebrates and seed heads. Various duck species have preferred foraging depths within this range; for example preferred water depths for mallards are 2.75-5.5 inches, while northern shovelers prefer depths of 6.3-9.5 inches (Frederickson 1991). Swans feed on aquatic plants and their tubers. For successful feeding, water depths must be less than 5 feet to allow swans to reach the submerged tubers (Mitchell and Eichholz 2010). Conversely, divers including canvasbacks, redheads, and lesser scaup are capable of locating food resources throughout the water column, from near the surface to depths of many feet (Baldassarre and Bolen 2006; Bellrose 1976).

Hemi-Marsh Management: Currently, 500-700 acres of hemi-marsh habitat (six impoundments, the "core" wetland units on the Refuge) are flooded annually, with the goal of providing waterfowl habitat, and public use opportunities. Dikes and water control structures at Camas NWR allow for improved hydrology and wetland function through precise manipulation of water levels. Much of the water control infrastructure at Camas NWR was constructed in the 1960s to provide waterfowl habitat. The Refuge's Camas Creek surface water rights and refuge groundwater pumping rights are managed to spring flood and maintain permanent to semipermanently flooded wetlands through the summer and fall, for consistent availability of hemi-marsh habitat, but little annual variability in wetland flooding regimes. There is one point of diversion along Camas Creek for surface water diversion to wetlands. Deep hemi-marsh wetland habitat is maximized by diverting the majority of Camas Creek surface waters (58.1 cfs) from April-July in an average flow year to inundate these impoundments. From this main diversion point on Camas Creek, water must flow two miles in order to reach the first managed wetland basin. At the time of refuge establishment, wetlands were flooded by artesian groundwater discharges. Currently continued groundwater pumping is needed to maintain wetlands through the summer.

Complete drawdowns of individual impoundments are conducted every five to seven years to recycle nutrients, increase germination of submerged aquatic plants, and allow for physical control of dense emergent vegetation, as warranted. Water levels are lowered as needed ("drought" flooding cycle) to encourage hardstem bulrush growth, increase bulrush stem density, and decrease open water interspersion. Late summer prescribed fire and fall mowing is used to reduce cover of emergent vegetation and set back succession to create or maintain open, shallow water areas and create mosaic patterns within wetlands when water level manipulations prove insufficient to maintain hemi-marsh attributes.

Shallow Marsh Management: The infrastructure at Camas NWR was designed to provide deepwater habitat; therefore; shallow marsh habitats fluctuate in size (40-60 acres) in response to hemi-marsh management. Under current management, shallow marsh habitat is located within and along the edges of hemi-marsh. Prescribed fire, disking, and mowing are used to reduce cover of emergents and create mosaic patterns within wetlands when water level manipulations prove insufficient to maintain shallow-marsh attributes.

Wet Meadow: As with shallow marsh habitat, existing water management infrastructure is designed for hemi-marsh habitat maintenance, limiting management options for wet meadows. Currently, ground and surface water rights are used to irrigate 80 to 100 acres of wet-meadow habitats annually. Management units within this habitat type are maintained and enhanced through the use of active successional vegetation management (e.g., haying through CLMAs).

Management of specific wetland units is described in detail below.

Wetland Management Units

Approximately 42 wetlands have been discretely identified on Camas NWR since its establishment. Many are wetland basins that have been modified by the refuge staff to improve wildlife habitat, most commonly for waterfowl benefit. There are 21 of these modified wetlands (see Table 4.9 and Map 12). Modified wetlands are both “active” (12), that is hydrated for management purposes, usually annually; or “inactive” (9), dry, diked basins for which adequate water is no longer available, the water delivery system is no longer functional, or both. Additional unnamed wetland basins that have not been structurally developed and receive no specific water management treatment also exist within the Refuge. Their number and extent have yet to be documented. Active wetland units are dominated by open water and persistent emergent vegetation (hardstem bulrush, cattail, and common spikerush), while most of the Refuge’s inactive wetland management units are native wet meadow habitat, dominated by Baltic rush, and non-native (ruderal) wet meadow and wetland vegetation.

The Ecological Integrity Assessment for Camas NWR (Kittel et al. 2012) delineated four wetland complexes: the Big Pond Complex, Center Pond Complex, Rays Lake Complex, and Camas Creek and Floodplain. These complexes encompass ponds that are linked by water source and direction of flow, creating a suite of interconnected ponds and their surrounding lowlands. Table 4.9 groups wetlands by Complex.

Another aspect of Camas NWR wetlands and wetland management is the concept of “core” units (Table 4.9). These are the principal ponds directly visible from the auto tour route, but there are more practical reasons for their ascent to high priority management targets over time. These wetlands exhibit a combination of high wildlife values that naturally make them a management priority, but the ability to deliver adequate water to most of them on a yearly basis elevates their management value and attractiveness. Due to climatic changes, decline of the local aquifer, and degradation of streamflows before and since refuge establishment, both the number and total acreage of refuge wetlands that can reliably be hydrated in any given year has precipitously dropped. Currently, the following Camas NWR wetlands are considered “core wetlands”: Big Pond, Redhead Pond, Center Pond, Two-Way, and Toomey. All of these except Big Pond are part of the Center Pond Complex.

Due to the infrastructure of the Camas NWR water delivery (ditch) system for both surface and subsurface water to ponds, water has to cross at least one other pond before arriving at the target wetland; this reduces management flexibility in terms of being able to either dewater some ponds in the upstream portion of the delivery system, or to efficiently deliver water to ponds on the downstream end of the system. During periods of water shortage, the core wetlands may be the only basins on the Refuge to receive any substantial amount of water.

Table 4.9. Active and Inactive Modified Wetland Basins at Camas NWR

Pond Name (boldface = core wetland; I = Inactive)	Acres*	Current Water Regime	NWI Classification	Vegetation/Cover Types from 2011 mapping (groups and alliances in parentheses)
		Big Pond Complex		
Spring Pond	(1) 75.13 (2) 31.08	Temporary, seasonal	Palustrine emergent (Persistent tall emergent)	Primarily hemi-marsh (mostly senescent tall emergent vegetation; small areas of hardstem bulrush.) Also lowland non-native (ruderal wet meadow), and wet meadow (Baltic rush). Condition: Fair.
Goose Pond (I)	17.64	Temporarily flooded to saturated	Palustrine emergent, Palustrine (Persistent emergent, unconsolidated bottom)	Lowland non-native (ruderal wet meadow); upland non-native. Condition: Poor.
Big Pond	113.59	Semipermanent with deepwater areas; dry in winter	Palustrine emergent (east side); palustrine flooded (west side). (Persistent tall emergent vegetation; unconsolidated bottom.)	Hemi-marsh (hardstem bulrush) (east side); open water (west side). Condition: Good
Brindley Pond	39.49		Palustrine emergent	50% wet meadow, 50% lowland non-native; small amount of riparian. Condition: Prob fair to poor; significant non-natives.
Flat Pond (I)	59.13	Temporarily flooded to saturated	Palustrine emergent, palustrine flooded (Persistent emergent, uncon-solidated bottom)	100% Lowland non-native (ruderal wet meadow). Condition: Poor

Table 4.9. Active and Inactive Modified Wetland Basins at Camas NWR

Pond Name (boldface = core wetland; I = Inactive)	**Acres***	**Current Water Regime**	**NWI Classification**	**Vegetation/Cover Types from 2011 mapping (groups and alliances in parentheses)**
Center Pond Complex				
Rat Farm Pond (I)	42.76	Temporarily flooded to saturated	Palustrine emergent, palustrine flooded (Persistent emergent, unconsolidated bottom)	Primarily lowland non-native (ruderal wet meadow Condition: Poor
Center Pond	329.00	Shallow; temporary, seasonal, and semipermanent	Palustrine emergent, palustrine flooded (Persistent tall emergent vegetation; unconsolidated bottom; mudflats)	West side: Hemi-marsh (hardstem bulrush) with small areas of open water; small areas of wet meadow, riparian scrub-shrub. Condition: Prob fair to good. East side: Extensive shallow open water (amaranth mudflat) merging to lowland non-native vegetation (ruderal wet meadow). Condition: Fair to poor.
Redhead Pond	67.96	Semipermanent with deepwater areas, dry in winter	Palustrine emergent, palustrine flooded (Persistent tall emergent vegetation; unconsolidated bottom.)	Open water, hemi-marsh (hardstem bulrush), wet meadow (Baltic rush) Condition: Probably good.
Toomey Pond	43.18 (S) 59.60 (N)	Temporary, seasonal, and semipermanent	Palustrine emergent, palustrine flooded (Persistent tall emergent vegetation; unconsolidated bottom.)	South end: Hemi-marsh (hardstem bulrush), open water North end (Toomey 2): Hemi-marsh (extensive cattails) Condition: Probably good
Two-Way Pond	63.74	Seasonal and semipermanent	Lacustrine	Hemi-marsh, open water. Condition: Probably fair to good.

Rays Lake Complex				
Avocet Pond	40.91		Palustrine emergent	Hemi-marsh
Sandhole Lake	254.04	Permanent, semipermanent, temporary, seasonal. Extensive deep-water areas that dry out infrequently.	Lacustrine, surrounded by band of palustrine emergent (Primarily limnetic unconsolidated bottom; also persistent tall, medium, and short emergent vegetation, palustrine scrub-shrub on NE shoreline.)	Primarily open water. Narrow margin of hemi-marsh (hardstem bulrush and other emergents); patch of wet meadow (common spikerush) on north lobe; riparian scrub-shrub (narrowleaf willow) on east shoreline. Condition: Good to excellent.
Mallard Slough	335.59	Temporary, seasonal, and semipermanent	Palustrine emergent, palustrine flooded (Persistent emergent; palustrine forested/shrub wetland)	Predominantly wet meadow (Baltic rush) with hardstem bulrush in deeper channels, and small pools of open water. Some significant shallow open water (amaranth mudflats). On W side predominantly hemi-marsh (common spikerush) with some riparian scrub-shrub (narrowleaf willow). Condition: Variable, mostly fair to poor but a good quality site mapped on the slough itself.
Rays Lake	615.40 part 13.26	Semipermanent and seasonal	Lacustrine, Palustrine emergent, Palustrine scrub-shrub (Unconsolidated bottom; Mudflats; palustrine scrub-shrub)	Primarily open water (both deep open water and amaranth mudflat), hemi-marsh (common spikerush), and riparian scrub-shrub (narrowleaf willow). Small areas of hardstem bulrush. South portion primarily wet meadow (Baltic rush) with some lowland non-native (ruderal wet meadow) in shallow areas. Condition: Variable but with some patches of good to excellent habitat
Cattail Flat	167.22	Seasonal	Palustrine emergent (Persistent emergent)	Primarily wet meadow (Baltic rush) on W side; hemi-marsh (common spikerush) on E side with inclusion of riparian scrub-shrub. Small areas of lowland non-native (ruderal wet meadow), hardstem bulrush.

				Condition: Primarily poor but with some patches of good quality habitat
Camas Creek and Floodplain Complex				
West Marsh (I)	77.14	Temporarily flooded to saturated; usually dry	Palustrine emergent (Saline wet meadow)	Primarily hay; some wet meadow (Baltic rush) and lowland non-native (ruderal wet meadow)
Moose Pond (I)	98.62	Temporarily flooded to saturated; usually dry	Palustrine emergent (Wet meadow)	Lowland non-native (ruderal wet meadow), wet meadow (Baltic rush).
Ruddy Pond (I)	46.68	Temporarily flooded to saturated; small area of seasonal	Palustrine emergent (Wet meadow with small marsh area)	Lowland non-native (ruderal wet meadow), wet meadow (Baltic rush). A little open water. Condition: Probably fair to poor.
Pintail Pond (I)	192.28	Temporarily flooded to saturated	Palustrine emergent, palustrine scrub-shrub. (Wet meadow; small areas of saline wet meadow, emergent, and upland)	Wet meadow (Baltic rush), Lowland non-native (ruderal wet meadow), shallow open water (amaranth mudflat), riparian scrub-shrub
Unnamed lakes/ponds (Incl NW#1,2)	61.00			
Total Active Modified Wetlands: 2,249.19 acres				
Total Inactive Modified Wetlands: 595.42				
Total Modified Wetlands: 2,844.61 acres				
Modified wetlands (n=21) Hydrated (Active) wetlands=12, Inactive Wetlands = 9				

* From Water Resource Inventory Areas (WRIA) 2011.
Adapted from Camas WRIA (USFWS 2011) and Ecological Integrity Assessment (Kittel et al. 2012)

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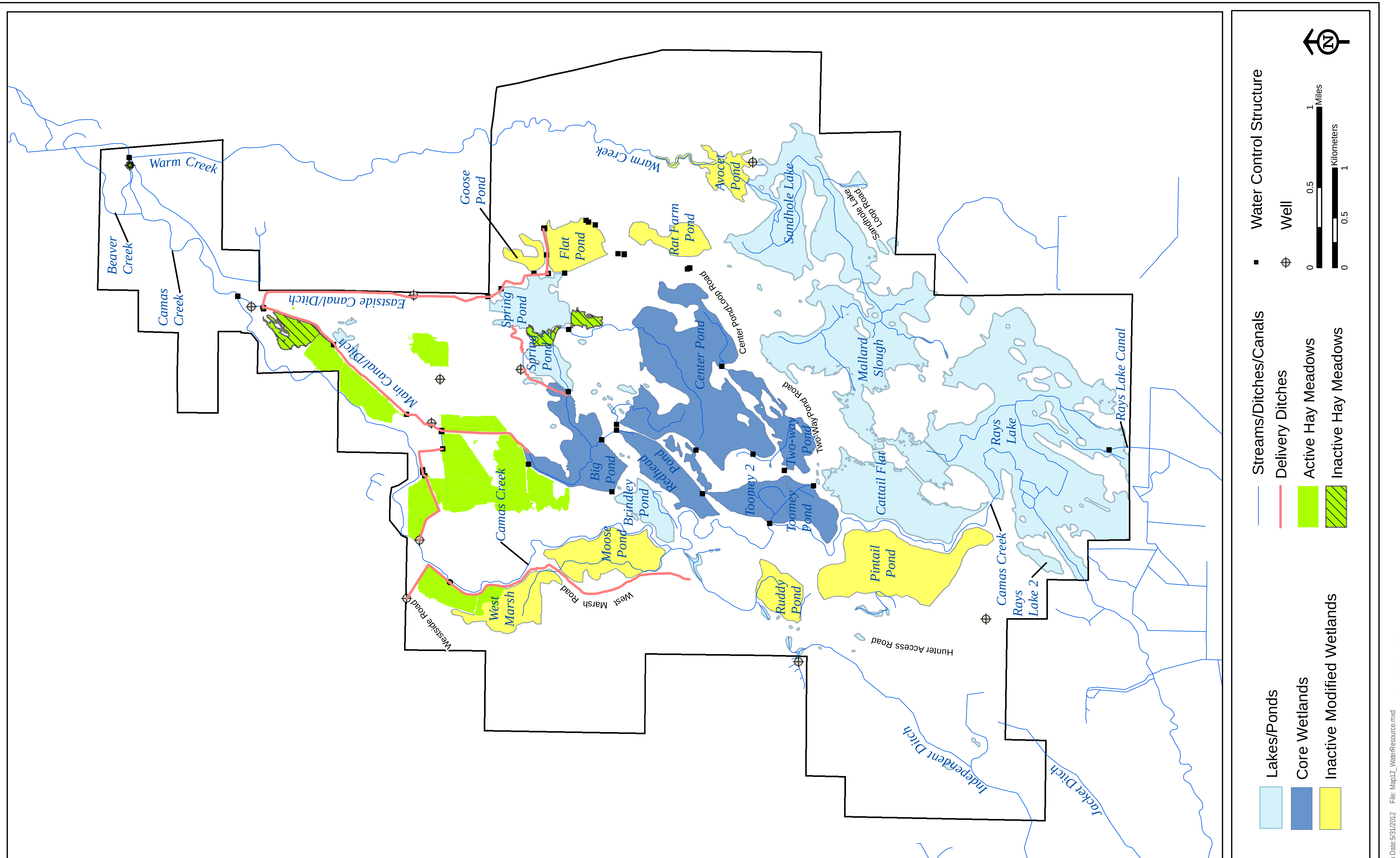
Map 12 Core, Active and Inactive Wetlands and Hay Meadows



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Meadow Management Units (hay meadows)

Hay meadows, like the wetland basins, have been named, or numbered, and delineated for specific management. There are nineteen of these meadow management units, of which fifteen are actively managed and four are inactive. These are classified as "agriculture" in recent vegetation mapping and will be discussed in Section 4.3.4 below.

Inactive Modified Wetlands

The inactive modified wetlands of the Camas NWR are an amalgam of management actions by both private landowners before refuge establishment, and habitat development after refuge establishment. There are two primary types of augmented wetland habitats: hayfields and waterfowl ponds. The hayfields, or meadows, were probably developed by settlers and ranchers, starting soon after settlement of the Camas area. These agriculturalists no doubt continued modifying these hay units to improve water delivery and hay production throughout their ownership of the properties. The irrigation/water conveyance infrastructure the private owners developed may, in some cases, have affected the waterfowl habitat (wetland) improvements later attempted by the refuge staff. The Refuge's habitat development efforts were intended to enhance waterfowl productivity, and generally consisted of the construction of water delivery systems, a dike, and nesting islands. All of these modified wetlands have dikes to some extent, but not all have ditch water delivery systems, nor do all have islands. The water delivery systems generally consisted of small irrigation-type ditches, with water control structures. Ring dikes were intended to facilitate control both of water depth, as well as extent of hydration. The earthen islands were constructed to provide more secure and attractive sites for waterfowl nesting. Both the inactive hay units and the dry waterfowl ponds are on hydric soils and occur within the wet meadow, saline wet meadow and marsh ecological sites, based upon NRCS soil survey delineations (Jorgensen 1979). Of these, wet meadow is the predominant ecological site among these formerly active wetlands. The National Wetland Inventory (NWI) delineates these modified basins as palustrine emergent, with temporary, semipermanent and permanent water regimes. The semipermanent and permanent rankings reflect the older NWI work from an era of a higher water table in the Camas Creek floodplain, and possibly a wetter climate. A more accurate ranking would be temporarily, or possibly seasonally flooded in a few restricted locations, i.e., some of the deeper depressions. Besides temporarily flooded, the other potential designation for most of these dry wetlands would be saturated. It is instructive to consider the definition of temporarily flooded versus saturated as described by Cowardin et al. (1979):

> *Temporarily Flooded.* Surface water is present for brief periods during the growing season, but the water table usually lies well below the soil surface for most of the season. Plants that grow both in uplands and wetlands are characteristic of the temporarily flooded regime.
>
> *Saturated.* The substrate is saturated to the surface for extended periods during the growing season, but surface water is seldom present.

There are a total of thirteen inactive wetlands within Camas NWR (see Map 12). These artificial wetlands include two different principal types and three type subsets. Nine are actual modified basins where an effort was made to create a more permanent, i.e., deeper, marsh through structural means, including provision of additional water. Supplemental water was supplied to these wetlands through three methods, either singly or in combination: well water through delivery ditches, Camas Creek water via delivery ditches, and Camas Creek flood flows. These include Goose Pond and Flat Pond (Big Pond Complex); Rat Farm Pond (Center Pond Complex); West Marsh, Moose Pond, Ruddy

Pond, and Pintail Pond (Camas Creek Floodplain Complex); and two unnamed large structures in the northeast quadrant of the Refuge, along Camas Creek. Four of these nine ponds were designed to receive both Camas Creek and well water via ditches: West Marsh and Goose, Flat, and Rat Farm ponds. These four wetlands cannot receive overland flow from Camas Creek in flood stage due to embankments. Three of the nine ponds (Moose, Ruddy and Pintail ponds) can receive both Camas Creek and well water via ditches, similar to the first subset, but Camas Creek flood flows can also reach them overland. Two artificial wetlands (unnamed structures along the northeast bank of Camas Creek) were designed to be hydrated solely with overflow waters from Camas Creek during flood stage. Reference to Map 12 is helpful in understanding the three wetland subsets.

The four other inactive wetlands are hay meadow types (unit numbers 2a, 2b, 10a, and 10b). All these hay meadows were watered either by well, or Camas Creek flows, delivered by ditch (refer to Map 12).

Modified Wetlands: Big Pond Complex

Spring Pond. The 106-acre Spring Pond unit is on the eastern leg of the Camas NWR water delivery system and is, in fact, the first unit on the system, i.e., closest to that irrigation pump. As such, Spring Pond can easily be partially hydrated, but the relatively large size of the basin and other higher priority units further downstream make this impractical.

Spring Pond was mapped as palustrine emergent wetland with a temporary and seasonal water regime. The existing vegetation/open water pattern within the basin is close to hemi-marsh; if the wetland could ever be regularly and substantially hydrated, it could no doubt produce some noteworthy waterfowl habitat. The pond’s hydrology does not simulate natural patterns due unnaturally frequent and prolonged dry periods, at least in the majority of the basin. On a fraction of the basin, that lowest and closest to the water delivery inlet, flooding and normal hydrologic cycles tend to occur annually.

Big Pond. The 114-acre Big Pond Unit, a core wetland, is one of the Refuge’s larger and deeper open water areas, and has historically been managed for permanent water. It is an amalgamation of wetland types, primarily palustrine emergent marsh with temporary to semipermanent water regimes. Big Pond also has significant portions of palustrine unconsolidated bottom, with both permanent and semipermanent water regimes. These palustrine unconsolidated bottom sites occur both as a combination with emergent marsh, persistent vegetation, and semipermanent water, as well as unmixed. Although portions of the pond are described as “permanent water” in the National Wetland Inventory (NWI), available water sources have declined to the point where a designation of “semipermanent” would be more accurate.

This maintenance of relatively deep, open and persistent water (although the pond is dry overwinter) provides habitat for diving ducks and trumpeter swans, although there are sufficient shallows, along with extensive tall emergent vegetation, to attract dabbling ducks as well. Waterfowl both nest and forage in this basin, which has been modified with a dike on three sides to increase basin depth and size. Of particular note, Big Pond normally has a trumpeter swan territory and often an active nest. Big Pond has been among the most productive trumpeter swan brood sites in the Greater Yellowstone Ecosystem. It receives considerable use by waterbirds and wading birds, although shorebird use is restricted due to the limited area of exposed, shallow shorelines. Most of the shoreline is vegetated and steep, as it is on an artificial dike slope. Due to its location in the Camas water delivery network, as well as the quality of habitat it provides, Big Pond is the core marsh unit for the Refuge.

Big Pond is hydrologically isolated from natural Camas Creek inflow. Water levels are maintained through a combination of snowmelt, Camas Creek water (artificially delivered through a refuge ditch, early in the season), and refuge well water pumped through the same ditch later in the year, after the Camas Creek flow has subsided. Refuge water rights are crucial in maintaining this wetland, which would cease to exist without them. Groundwater influx is probably not a factor in Big Pond.

Water levels have not followed a typical historic hydrograph with high spring flows, followed by rapid summer drawdown, and a slight increase in wetland water levels during fall. Rather, the current Big Pond hydrograph features high spring flows, but rather than attenuating rapidly, as in naturally functioning wetlands, artificially high flows continue into the summer period, maintaining unnaturally high water levels in the wetland throughout spring, summer, and fall. The extended duration of flooding probably has led to a reduction in the spring flush of invertebrates. Because the water levels remain high, there is no subsequent summer concentration of critically important bird forage (Bundy 2007). Big Pond has both surface and subsurface sources in the refuge water delivery system.

Brindley Pond. This small (40 acres), hallow wetland has a vigorous and diverse plant community. When combined with the extended drawdown (drought) and soil aeration, this creates impressive productivity (and wildlife use) when the pond is flooded. Brindley Pond consists primarily of palustrine emergent marsh with seasonal and semipermanent water regimes. The wetland is reminiscent of a hay meadow, which it probably historically was, with the additional of some depressions which support tall emergent vegetation. Historically in higher moisture periods, and currently when the unit is irrigated, these basins are hydrated, and much of the higher elevation surface is covered with shallow water. The unit has been rarely flooded, and is typically in drought condition. However, in 2010 and 2011 the unit was irrigated, maintaining at least the deeper basins in water through the majority of the frost-free period. Groundwater contributions within this wetland are not known. Flood and normal hydrologic conditions usually only occur in very wet years, or when management applies ditch water. Water for this unit must come from Big Pond.

Goose Pond (Inactive). Goose Pond is one of the smallest of the Refuge’s developed wetlands (18 acres). It is diked and is served by a ditch from Well #8. Flow can also be augmented from Well #4 and Camas Creek water can be diverted down the same delivery ditch. Goose Pond’s ecological sites are predominantly marsh with some moderately extensive sandy uplands. As with Ruddy Pond, upland sites were included in this wetland development, either as nesting islands, for ease of construction, or to increase the new wetland area. These uplands were also captured in the NWI mapping, but the main delineation was a compound designation of palustrine emergent persistent vegetation with unconsolidated bottom and a semipermanent water regime. Although Goose Pond is almost always dry, the wetland system, class and subclass appear accurate, but the water regime is now temporarily flooded, or saturated.

Flat Pond (Inactive). At 59 acres, Flat Pond is larger than Goose Pond and also must be hydrated via well and ditch. Like Goose Pond, Well #8 is the water source for Flat Pond, but flows from Well #4 and Camas Creek can be used as well. The vast majority of Flat Pond is typed as a marsh ecological site, with a small portion of sandy upland site that was included in this wetland development. Flat Pond is primarily palustrine emergent vegetation with a semipermanent water regime, followed by palustrine unconsolidated bottom with permanent water. Flat Pond also has inclusions of palustrine emergent vegetation with a seasonal water regime, palustrine unconsolidated shore with seasonal water, and uplands. The NWI mapping actually identified more upland parcels than the ecological site mapping did. As with the other palustrine systems and classes, the water regimes for every site in this wetland would now be classified as temporarily flooded, or saturated.

Modified Wetlands: Center Pond Complex

Center Pond. Another core unit, the 329-acre Center Pond unit also must receive its flows from Big Pond. Due to its extremely large size, only a fraction of the Center Pond basin is normally hydrated in recent times. There is simply insufficient spring runoff the majority of years, and Center is now dependent on flood flows if the high water mark is to be reached. With the depleted Snake River aquifer, refuge wells cannot begin to supply the water necessary to fill the soil profile and then the wetland basin, even if unlimited funds were available to support the pumping. (Due to diking, Center Pond appears to be larger than it ever was naturally.) In spite of limited hydration, Center Pond is large enough to provide a diversity of productive habitat for waterfowl, waterbirds, and wading birds, as well as a host of other marsh fauna. Although possessing some zones of deeper water, most of Center Pond is a shallow seasonal-to-semipermanent wetland. This generally shallow water tends to allow a high percentage of the basin to dry out and become aerated. Consequently, when Center Pond does receive flows, these previously dried areas are typically very productive and receive correspondingly high use from waterfowl and waterbirds. Center Pond’s bathymetry also produces more exposed and available mudflats for shorebird use than any other Camas NWR wetland, except Rays Lake.

Center Pond was delineated as primarily palustrine emergent marsh with temporary, seasonal and semipermanent water regimes. Palustrine unconsolidated bottom,emergent marsh, and persistent vegetation with a semipermanent water regime have also been identified in Center Pond. An uncommon wetland class for Camas NWR--lacustrine, littoral, unconsolidated bottom, with a permanent water regime—is found in Center Pond. This permanent aquatic rating should be redefined as semipermanent or seasonal, since the wetland’s water regime has deteriorated since mapping. Although mapped as lacustrine, the area generally appears to exhibit more of a palustrine character. Perennial emergent hemi-marsh quality is difficult to maintain in Center Pond, due to unreliable water supplies. However, facilitated drawdown results in a moist-soil management response, similar to that described by Bundy (2007) for the Mud Lake unit at Bear Lake NWR.

The hydrograph for Center Pond more closely simulates a natural pattern, since it receives early flows during normal spring runoff, but unlike Big and Redhead which continue to be augmented post-runoff by well water, Center usually receives little artificial water enhancement once spring flows subside in Camas Creek. Additionally, the Center Pond’s soils have a coarse, sandy texture and do not appear to hold water well. Finally, groundwater influx is not known to be significant factor in Center Pond. Due to these characteristics, Center Pond begins to dewater (in years when it has any water at all) soon after Camas Creek flows decrease significantly. This produces a drying/drawdown cycle that somewhat simulates the periodicity of a natural system, with the pond normally dry by late summer. In moderately dry years, there may be enough water to partially hydrate Center, but the basin can dry out before waterfowl and waterbirds have had sufficient time to fledge their young. Normally, this brood water failure is somewhat ameliorated by the proximity of other wetlands, such as Toomey and Redhead, to which stranded Center Pond broods can move; although, juvenile mortality is no doubt increased by such events. Water sources for Center Pond are both surface and subsurface, but only Camas Creek flood flows are sufficiently large to significantly fill this wetland.

Redhead Pond. The 68-acre Redhead Pond, a refuge core wetland, receives all of its flows through Big Pond. Past management has focused on reaching full pool by mid-April. At this point, water levels are maintained for breeding waterbirds through at least mid-July, and often through majority of the summer and fall. Though not known as an actual trumpeter swan nesting territory, Redhead has functioned as an alternate brooding area for the Big Pond pair. In certain years this pair moves between the two wetlands with their brood and has probably actually finished the fledging process on Redhead. The basin also regularly receives use from other trumpeters when not defended by a territorial pair. The initial portion of a normal flood hydrologic regime is maintained in most years, but the mid-late season drawdown portion is often lacking. Groundwater influx is probably not a factor in Redhead Pond.

Redhead is a relatively diverse wetland, consisting primarily of palustrine emergent vegetation marsh types with temporary, seasonal, and semipermanent water regimes. A combination wetland site of palustrine emergent and unconsolidated bottom with semipermanent water has also been mapped. Additionally, there is a palustrine unconsolidated bottom marsh component with a permanent water regime. As in the case of Big Pond, Redhead Pond is dewatered every winter and there is effectively no permanent water in this wetland; this needs to be reflected in the NWI delineations.

Waterfowl use indicates at least fair forage productivity in Redhead, but continued hydration and lack of drawdown may threaten that fecundity. Long-term management of Redhead has been focused on producing waterfowl and providing brooding, and then migration, habitat. Some shallow shoreline habitat, as well as occasional exposed mudflats, is provided in some years to benefit sandhill cranes, other wading birds, and migratory shorebirds. Redhead Pond can be supplied by either surface or subsurface water sources.

Toomey Pond. The 103-acre Toomey Pond, a core wetland unit, is a composite of palustrine emergent marsh with temporary, seasonal and semipermanent water regimes. An open water type combination of palustrine unconsolidated bottom and emergent marsh with persistent vegetation and semipermanent water also exists on Toomey Pond. The wetland is currently providing productive hemi-marsh habitat over a significant portion of its surface.

Toomey is one of the larger wetlands on the Refuge and has at least moderate habitat diversity, which combines to make it one of the Refuge's more productive units. Toomey's location within the water delivery system makes it likely that a high proportion of its basin can be hydrated annually. While positive in a traditional wetland management view, this nonetheless reduces the ability of this unit to mimic a natural hydrograph. Similar to Big Pond and Redhead, Toomey Pond receives its largest flows in early spring, but has usually been kept artificially hydrated throughout the spring, summer and fall. As with other continuously hydrated wetlands, this management approach can cause a decrease in wetland productivity. Long-term management of Toomey has been focused on producing hemi-marsh conditions for migrating and breeding waterfowl and waterbirds. The pond typically receives substantial waterfowl use, including by a territorial pair of trumpeter swans. There have been years when Toomey produced the only trumpeter cygnets on the Refuge. Water sources for this wetland are both surface (Camas Creek) and subsurface.

Two-Way Pond. The 64-acre Two-Way Pond is a core wetland unit for Camas NWR, delineated in the NWI as lacustrine limnetic unconsolidated bottom with a permanent water regime, and palustrine emergent persistent with a semipermanently flooded regime. The lacustrine designation should be changed to a palustrine unconsolidated bottom with a semipermanent or seasonal water regime. Additionally, previous wetland mapping identified a palustrine scrub shrub seasonal (PSSIC) site that no longer is indicated on the wetland map. Since willows continue to exist, and probably expand, on Two-Way Pond, the PSSIC should be again added to the wetland map.

When annual water supplies are sufficient to allow hydration, Two-Way Pond provides an optimal mix of habitat for a wide diversity of wetland dependent wildlife. Wetland management within Two-Way Pond is dependent on both Camas Creek and well water sources; normally, due to the difficult location of Toomey within the Refuge water delivery net, only surface, or runoff flows are used. Two-Way Pond cannot be filled every year, and since water supply is less dependable, a “drought” hydrologic regime can more easily, and regularly, simulated than “flood” and “normal” regimes. The heavy use of Two-Way Pond by waterfowl and other aquatic birds indicates that the wetland is, in fact, quite productive. Groundwater influx is not known to be a significant factor in Two-Way Pond.

As will be characterized further in the Sandhole and Rays Lake discussions, willow (primarily coyote willow, *S. exigua*) has established on Two-Way Pond, near the southwest corner of the unit. It is currently providing passerine and perhaps some limited waterfowl habitat. The stand is too small to be of value as elk habitat, but could possibly offer that in the future if it continues to expand. The water regime within this wetland type ranges from seasonal to temporary along a gradient from shoreline to uplands.

Rat Farm Pond (Inactive). This 43-acre pond lies on the west side of the wetland complex, near Warm Creek. It is currently primarily lowland non-native vegetation and in poor condition. Potential water sources are Well #4 and #8, as well as Camas Creek. Rat Farm Pond was mapped as a marsh ecological site in 1988, with sizeable area of water identified. Additionally, there were small inclusions of sandy uplands. Rat Farm Pond’s wetland mapping showed mainly palustrine emergent, persistent vegetation, semipermanent water regime, followed by palustrine unconsolidated bottom, permanent water regime and then palustrine emergent, persistent, seasonal water. The water regimes for every site in this wetland would now be classified as temporarily flooded, or saturated.

Modified Wetlands: Rays Lake Complex

Sandhole Lake. The 254-acre Sandhole Lake is situated in the southeast corner of the Refuge and unconnected to the main water delivery system. There are two options for surface water for Sandhole, neither dependable in any given year, especially for significant amounts of water. Surface flows can only reach Sandhole via Warm Creek to the north, or through Mallard Slough to the south. Warm Creek passes through private land north of the Refuge and is encumbered due to flooding hazards at that point. Consequently, Warm Creek rarely flows into Sandhole Lake. The southern option through Mallard Slough is actually a reverse current/flow situation, whereby Rays Lake in the extreme southwestern quadrant of the Refuge must fill to the point where water starts to flow northerly toward Mallard Slough and ultimately Sandhole. The conduit is the natural outflow channel of Sandhole Lake which sequentially connects to Mallard Slough, Cattail Flat and finally Rays Lake. This artificial reverse flow from Rays Lake is the principal surface flow delivery scenario for Sandhole, but only occurs in wet years. Sandhole does have its own well and pump and can be augmented with subsurface water, but the amount available is insufficient to substantially affect the lake’s water level. It is assumed that a considerable portion of Sandhole’s water is derived from spring runoff from adjacent uplands, and that groundwater influx is a significant factor in this basin, but no investigations have been performed to confirm these theories. Regardless, Sandhole is the only refuge wetland that can subsist entirely on its own water supply in most years and it rarely goes dry.

Sandhole Lake is the deepest unit in the complex and one of the most conducive to maintaining hemi-marsh habitat, although most of the lake is currently open water habitat, primarily delineated as a limnetic unconsolidated bottom wetland with a permanent water regime. Sandhole also has significant representations of palustrine emergent marsh with temporary, seasonal and semipermanent water regimes. As previously mentioned, a semi-unique habitat class for Camas NWR wetlands is palustrine scrub-shrub, which occurs to a significant extent only on Sandhole and Rays Lakes. This is discussed in Section 4.3.2 below.

Water quality subjectively appears to be quite good, which greatly enhances aquatic submergent plant growth. Due to lack of normal watershed inflow, very little sediment appears to have been deposited within the unit, which also leaves the substrate in good condition to stimulate growth of submergent plants. The major limitation on this unit is the inability to drain, or otherwise dewater Sandhole Lake through management action. The basin will sometimes dry in a drought year, although infrequently. While this long period of hydration may lower the long-term productivity of Sandhole Lake, avian and other wildlife use of the wetland appears to remain high. The pond's character is natural; it has not been significantly modified anthropogenically, and remains hydrated due to a combination of its relatively great depth, as well as a probable groundwater nexus. It is probably inaccurate to characterize Sandhole Lake's hydrograph as unnatural, since mainly natural forces, or situations, are keeping the basin hydrated longer than an average Camas floodplain wetland.

Sandhole receives significant use from multiple waterfowl classes, reflecting the quality and diversity of its habitat. Ducks, geese, swans and waterbirds preferentially select this wetland to fulfill certain life history events. For example, the extensive open water areas provide ideal protection for molting birds; deep water zones attract diving duck species; shallow water areas provide ideal dabbling duck habitat; stands of medium and tall emergent vegetation provide good waterfowl brood cover; interspersed reaches of bare, or short cover shoreline present attractive loafing areas; and minnows provide an ideal food source for piscivorous species. Again, probably due to its large size and apparently good water quality, Sandhole receives substantial use by nonbreeding trumpeter swans.

Mallard Slough. Mallard Slough (336 acres) is another, broad, flat, large wetland similar to Cattail Flat. Both have the potential for considerable productivity in terms of waterfowl and wildlife habitat, both in terms of quantity and quality; but productivity is currently limited due to lack of water availability. Situated at a critical juncture in the water supply system between several other wetlands, Mallard Slough has an added challenge in maintaining water levels throughout the growing season. Snow melt tends to raise annual spring water levels. However, depths are typically inadequate to maintain water through the summer and the wetland must be augmented with either Camas Creek spring flows (surface water), backing in from Rays Lake, or well water pumped through Sandhole Lake. In reality, the capacity of the Sandhole Lake pump is inadequate to, in itself, make a significant contribution to Mallard Slough. When water actually flows into Mallard Slough from Sandhole Lake, it is ordinarily due to a "wet" year with high runoff flows into Sandhole Lake and through it to Mallard Slough. Groundwater contributions at Sandhole Lake may also have substantial impact on Mallard Slough in wet years, although this is conjecture. It is unknown if significant groundwater sources exist within the Mallard Slough basin.

The normal situation is for Mallard Slough to have some early season water, at least in pools, or sloughs across the wetland, without necessarily having any flow that actually crosses the entire depression. In average water years, there is not adequate moisture to maintain water in Mallard Slough throughout the spring, summer and fall. Consequently, with the exception of the confluence with Sandhole Lake, the slough typically dries between mid-July and mid-August. Similar to Center Pond, broods produced at Mallard will often have to move to another, more permanent wetland, to complete fledging. Drought has tended to be the principal condition of Mallard Slough on a season-long basis. Flood and normal conditions are usually of very limited duration. Even though Mallard

Slough may actually experience “micro floods,” or begin with essentially normal hydrologic conditions in the spring, these states last such a short time that the impact to the wetland is negligible, and it actually finishes the average year in drought condition. Hydrating the northern segment of the sub-impoundment would greatly enhance habitat availability for migrating and breeding shorebirds.

Mallard Slough is principally composed of palustrine emergent marsh, persistent vegetation with temporary to semipermanent water regimes. It always provides some palustrine open water with a semipermanent water regime, as well as palustrine unconsolidated bottom habitats with both semipermanent and permanent water. The permanent water designation should be reduced to seasonal or semipermanent. The only example of palustrine freshwater forested/shrub wetland found on Camas NWR occurs on Mallard Slough and is described in Section 4.3.2 below.

Rays Lake. At 629 acres, Rays Lake is the largest of Camas NWR’s wetlands, but habitat quality is limited and intensive water level management is not possible. Composed mostly of open water habitat, with poor water quality and variable shoreline habitat quality, Rays Lake was delineated in the NWI primarily as lacustrine, littoral, unconsolidated bottom and permanent water in the primary basin; with palustrine emergent marsh (either with seasonal or semipermanent water) surrounding the deeper basin. There are also inclusions of palustrine scrub-shrub and unconsolidated shoreline, both with seasonal water regime and unconsolidated bottom with semipermanent water. All the permanent water (lacustrine) and semipermanent water regimes described have probably declined since initial wetland delineation. The permanent classification should be changed to semipermanent, and a significant portion of the semipermanent changed to seasonal. Although mapped as lacustrine, Rays Lake generally appears to exhibit more of a palustrine character.Rays Lake also has extensive areas of palustrine scrub-shrub (willow thickets), which are discussed further in Section 4.3.2 below.

With poor water quality and a high evapotranspiration rate, Rays Lake does not appear to be a highly productive wetland. However, waterfowl and waterbird use of this basin is moderate to high, possibly because Rays Lake is totally dewatered, or nearly so, every year. It is assumed that groundwater influx is not a significant factor in Rays Lake. It is, however, heavily influenced by off-site private irrigation interests whose water rights control the elevation that the Rays Lake pool can attain, and more importantly how quickly Rays Lake is drained to supply irrigation water to private lands surrounding the Refuge. Besides annual precipitation in the upper watershed, the annual irrigation demand on Rays Lake is the principal determinant of the duration of the lake’s pool. In terms of hydrologic regimes (i.e., flood, normal, and drought cycles), the first two are achieved most years, but the drought cycle is too pervasive. The wetland needs more periods of more extensive hydration.

Cattail Flat. The 167-acre Cattail Flat unit is a broad wetland expanse which, under current conditions, is fully hydrated only infrequently. It is essentially a shallow emergent hemi-marsh, currently trending toward overly robust emergent vegetation. While the majority of this basin is typed as palustrine emergent, there is palustrine open water mapped within it and additional open water habitat is clearly achievable, no doubt having been so in the past. There are also minor inclusions of palustrine unconsolidated shoreline. Much of the water regime was classified as semipermanent, but is probably now seasonal. Given the extensive shallows and rich vegetation communities, this wetland has the potential for substantial wildlife productivity, but suffers from a lack of water. Cattail Flat is fed either from Sandhole Lake, or more substantially, but less frequently, from Rays Lake flows backing upstream, as previously described in the Sandhole Lake account. In terms of normal/natural hydrologic cycle, Cattail Flat is continuously attenuating in the drought phase.

Avocet Pond (Inactive). Avocet Pond is a small (41 acre) wetland just north of Sandhole Lake. Currently most of the pond is shallow emergent hemi marsh, currently trending towards overly robust emergent vegetation. A small island of upland habitat lies within the center of the wetland.

Modified Wetlands: Camas Creek Floodplain

West Marsh (Inactive). West Marsh is a medium-sized (77 acres), dry, diked wetland in the northwest section of the Refuge. Besides the dikes and the nesting islands, a water delivery system from Well #3 was constructed to hydrate West Marsh. Well water has not been supplied to West Marsh for many years due to pumping costs, high water loss in conveyance ditches, and higher priority water use. Even with two potential water supply sources, West Marsh has been dry for the majority of the last 30 years, but does occasionally fill during an extremely high runoff event, such as a 100-, or 500-year frequency storm. Limited pools probably form within West Marsh's basin, but it has only been significantly hydrated once in the last ten years, in 2005. West Marsh is unique among Camas NWR artificial dry wetlands in that a sizeable portion of it is a saline wet meadow ecological site. The majority of West Marsh is ecologically delineated as wet meadow. The wetland classification for this basin is palustrine emergent with a temporarily flooded, or saturated, water regime.

Moose Pond (Inactive). Moose Pond is a medium sized wetland (99 acres). Moose Pond is more typical of refuge wetland ecological mapping in that it is a wet meadow site. It is composed entirely of palustrine emergent vegetation with a temporarily flooded, or saturated, water regime. Moose Pond is hydrated slightly more frequently than West Marsh, since a higher percentage of its eastern perimeter abuts Camas Creek. This increases the probability of hydration from early season stream overflow, or flooding. Moose Pond, like West Marsh, can receive water from Well #3 via a delivery ditch, but has not been so supplied for many years. Regardless of its more favorable location and the availability of auxiliary well water, Moose Pond has been dry for the majority of the last several decades.

Ruddy Pond (Inactive). Ruddy Pond is a small (47 acres) wetland situated further from the Camas Creek channel. Consequently, Ruddy Pond receives water from Camas overflow less regularly and, although hydrated in the high water year of 2005, has been dry for the majority of the last 30 years. Ruddy Pond has a limited well water source via ditch and buried pipe from Well #3. Ruddy Pond is primarily a wet meadow site, but also has a small marsh inclusion. A significant portion of the basin is a sandy upland site, which is not unusual in some larger wetland development projects on the Refuge. Uplands would sometimes be included in wetland developments when levees were being constructed in order to provide areas of naturally higher elevation to act as nesting islands. Ruddy Pond is mapped as primarily palustrine emergent vegetation with a temporarily flooded, or saturated, water regime, and a smaller percentage of its area delineated as seasonal water. All of Ruddy Pond should be currently delineated as temporarily flooded.

Pintail Pond (Inactive). Pintail Pond is the largest of the Refuge's inactive wetlands (192 acres). Pintail Pond is adjacent to the Camas Creek channel and, like Moose Pond, more frequently inundated by the creek's flood waters. Like nearby Ruddy Pond, Pintail Pond was last hydratedin 2005, but has been dry for most of the past 30 years. Again similar to Ruddy Pond, Pintail Pond has a secondary water source, Well #3. Pintail Pond is primarily a wet meadow ecological site, but also has small inclusions of marsh sites around its northern and eastern perimeter. A very small portion of the basin is a saline wet meadow site. Palustrine emergent marsh with a temporary water regime is the principal NWI wetland type mapped on Pintail Pond, with a lesser amount of seasonal water regime.

As with other presently dehydrated sites, the seasonal water regime would now be classified as a temporarily flooded or saturated. The Pintail Pond wetland community map also displays a significant inclusion of upland (38 acres).

Prescribed Fire

Prescribed fire has been used on the Refuge since 2001, primarily to set back vegetative succession and create openings in dense emergent vegetation. In wetlands, both spring (March 1-April 15) and fall (September 20-October 30) burns have been used. The history of prescribed fire use on the Refuge to date is included in Section 4.1.3 above. Fire models and history are discussed in Chapter 3.

4.3.2 Willow Riparian and Scrub-Shrub Habitat

Overview

Willow habitat, dominated by narrowleaf willow (also called coyote or sandbar willow, *Salix exigua*) occurs on 279 acres of the Refuge, about 2.6 percent of the Refuge's total acreage (Miewald et al. 2012). Willow habitats include both linear stream riparian habitat and palustrine scrub-shrub habitat in patch, or stand/thicket configurations.

Riparian Habitat is defined as natural stream or artificial water course habitat predominantly consisting of native willow species with a wet meadow understory, typically subject to an ephemeral, spring flooding regime (>0-12 inches in depth) (Bundy 2007). Willow riparian habitat primarily occurs along Camas Creek. Typically willows are present in linear configurations extending only a short distance from the stream banks. The three streams crossing the Refuge, Camas, Beaver, and Warm Creeks, all fall within the NWI classification of riverine intermittent streambeds, with a seasonally flooded water regime. Riverine Intermittent Streambed is a nationally decreasing habitat type. It is the willow overstory above the mix of wet meadow plants that make riverine intermittent streambed critically important for a variety of migratory and breeding landbird species. Willow communities support both terrestrial and semi-aquatic insects that are an important forage base for both fish and passerine birds. Willow communities are also important in maintaining water quality for fish by stabilizing banks and shading water. Stream riparian habitat on the Refuge is dominated by narrow-leaf willow (*Salix exigua*), with sporadic representation of a variety of other species that have not been thoroughly surveyed and described. A small area, approximately 9 acres, of crack willow (*S. fragilis*) was documented in the 2011 vegetation survey. Probable minority members of the stream riparian plant community would be peachleaf willow (*Salix amygdaloides*), Drummond willow (*Salix drummondiana*), Bebb willow (*Salix bebbiana*), Geyer willow (*Salix geyeriana*), Woods rose (*Rosa woodsii*), western snowberry (*Symphoricarpos occidentalis*), and currants (*Ribes* sp.), among others. Table 4.10 (below) describes key ecological attributes and desired conditions for riparian habitat.

Other willow patches occur in wetland basins and are considered **palustrine scrub-shrub wetlands**, with temporary to seasonal water regimes. Vegetation is less diverse than stream riparian and more typical of the native Camas Creek floodplain vegetation. The largest patches occur on Rays Lake. Here, large thickets of narrow-leaf willow occur at the mouth of Camas Creek and along the outlet from the lake, along the shoreline on both sides of the northeastern dike, and around the shore of the easternmost bay. Willows are pioneering widely across the lake basin along the northeast shoreline. As at Sandhole Lake, these stands range from linear ribbons hugging the shoreline to patches of 20 or more acres; but unlike Sandhole, at Rays Lake the larger groves tend to extend more into the frequently dry lakebed, rather than into the uplands. All of these groves are important to landbirds, particularly passerines. However, the largest Rays Lake stands are probably critical for the refuge elk herd. More study is needed to determine the exact value of the woody riparian zones, but they are probably providing escape and thermal cover for elk, as well as some forage. Due to the relatively flat topography of the Refuge, as well as generally short vegetation, habitat that is tall and dense enough to provide visual obscuration and to act as a wind and weather barrier, is limited. Consequently, elk use of the Rays Lake willow groves is heavy. The Rays Lake stands appear to be principally a tall shrub form narrowleaf willow, with an occasional Bebb, or Geyer, tree-form willow.

The only example of palustrine freshwater forested/shrub wetland found on Camas NWR occurs on Mallard Slough. As with other palustrine systems, this site is characterized by wetland dominated by trees, shrubs, emergent vegetation, mosses or lichens, and woody vegetation that is 6 m (18 feet) tall or taller; is composed of broad-leaved deciduous trees or shrubs; and has a temporary water regime. This site consists of a mature stand of willow trees (*Salix* sp.) along a small drainageway on the south side of the marsh, leading into Rays Lake.

Smaller thickets of willows are found in other wetlands such as Sandhole Lake, Two-Way Pond, and Pintail Pond. Thickets of narrowleaf willow are found along the northeast shoreline of Sandhole Lake. As at Rays Lake, the water regime is temporary or seasonal, depending on elevation. These stands range from linear ribbons hugging the shoreline to patches extending several acres inland from the shore. Similar to but much smaller than the Rays Lake willow thickets, these woody riparian habitats provide habitat for migratory landbirds, as well as forage, escape and thermal cover for elk.

Table 4.10. Key Ecological Attributes, Indicators and Desired Conditions—Riparian

Key Ecological Attributes	Indicators	Desired Conditions
Hydrology/hydroperiod	Ephemeral spring flooding regime	Natural or simulated flooding to stimulate growth and germination of native riparian vegetation; duration sufficient to provide soil moisture sufficient for plant growth and germination without damaging flood levels that erode soil or drown plants.
Vegetation diversity and structure	Healthy woody riparian communities with native understory suitable to the site.	Self-sustaining Salix overstory with understory of native shrubs and/or wet meadow vegetation.
Patch size	Sufficient to ensure normal ecological function and meet life history needs of all riparian dependent wildlife.	Normal range of use and nesting success for foraging and/or breeding birds, especially colonially nesting great blue herons, black-crowned night-herons, and breeding yellow warblers. Adequate for escape and thermal cover for moose, elk, white-tailed and mule deer.
Invasive species	Few to no invasive plants present	Little or no Russian olive, knapweed, leafy spurge, thistles, or other invasive plants.
Human use	Little to none.	Prohibit or limit entry to sensitive areas, except for vegetation and wildlife monitoring.

Regional Distribution, Conditions, and Trends of Riparian and Scrub-Shrub Habitat

Instream and Riparian. Riparian habitats in the Beaver-Camas watershed are threatened by altered and insufficient flows to sustain native vegetation due to legal and illegal diversions, increased demands on surface and groundwater by exurban development and agriculture, vegetation removal, altered channel morphology and reduced water quality caused by improper livestock grazing, beaver removal, over-browsing by moose and beaver (an unlikely threat given current population levels), and fire.

Several creeks (Camas, Beaver, and Warm Creeks) flow into Camas NWR but do not originate there, and significant portions of the watershed lie outside the Refuge. Off-refuge upstream activities have major impacts on water quality and quantity. Restoring riparian habitats would require cooperative efforts between the Service, USFS, Trout Unlimited, NRCS, and landowners throughout the Beaver-Camas Watershed.

The annual streamflow patterns of Camas Creek are essentially the same as occurred historically until the irrigation season begins around the 1st of April. However, this does not allow for overland flows to occur as they did historically, due to the deep incising of the Camas Creek channel, as compared to its original contour prior to Euro-American settlement. As previously described, the creek channel has experienced accelerated erosion through the cleaning and channelization activities of irrigation interests, as well as increased and altered (flashier) flows due to the effects of grazing, farming, and timber harvest within the watershed. In spite of significant water rights, the Refuge has been unable to artificially maintain both wetland levels and instream flow during, for example, critical late spring/early summer months necessary to support spawning, or survival, of Yellowstone cutthroat trout. This is true of both Camas Creek and other refuge streams. This example demonstrates the extreme departure of the Camas Creek floodplain from its historic, natural state. The effect of altered hydrology on the meadows adjacent to the streams has been somewhat less dramatic than the complete demise of the salmonid fishery, but is nonetheless severe. Through the remnant hydrologic function within, primarily, Camas Creek, and supplementation with deep well water, the Refuge has been able to provide a vestige of the historic meadow habitat used by a wide variety of wetland and riparian-dependent wildlife species for nesting and brood-rearing.

As noted above, Kittel et al. (2012) ranked the ecological integrity of both wetland and upland sites at Camas NWR, and wetland complexes, including the Camas Creek and Floodplain Complex. Metrics are described under Section 4.3.1 above. The Camas Creek riparian area and floodplain received few excellent scores and several poor scores for a total EIA score of “C” or fair. The landscape context of the riparian corridor is good, since natural uplands and adjacent wetlands surround the corridor (an “A” score). The buffer index score is poor (“D”), since the buffer is interrupted by roads, ditches, and agricultural use, mostly on the north and west sides, less so on the south and east side; the buffer width is constricted by the refuge utility compound, roads, and agriculture that occur within the 100 m (328 feet) buffer; and there are areas of continuous weedy vegetation. The overall Landscape Score combines the Landscape Context and Buffer Index Scores, into a “C” (fair) score.

The absolute size of the riparian corridor is a healthy 6 mile plus corridor and ranked an “A” score. However the relative size, compared to historic conditions, has been reduced through alteration of stream banks and floodplain, narrowing the riparian corridor. Therefore the relative size ranking is “C” (fair), and the total Size ranking is “B” (good).

The Condition score consists of vegetation, hydrology, and soil condition scores. Vegetation condition in the floodplain of Camas Creek is highly altered. There are areas where the land has been leveled and cleared and quackgrass (*Agropyron repens*) planted, and weeds such as Canada thistle (*Cirsium arvense*) are abundant. There are areas of native woody riparian shrubs along the river banks, and areas with very few weeds. However these weed-free areas are tiny relative to the amount of altered land within the Camas Creek floodplain. Vegetation scores therefore averaged out to a “D” (poor) score. The hydrology of the river channel has been altered in several ways: ditches remove water from the stream channel both upstream, midstream, and downstream of the Refuge, reducing the natural water source of in-stream waters and changing the hydroperiod (timing and duration of seasonal high and low flows). The immediate channel has been dredged and the stream banks augmented in height, whichreduces the hydrologic connection of the channel with the floodplain, so that overbank flooding happens less frequently. Hydrology scores are all very low (D for hydrologic connectivity, hydroperiod, and water source). Current soil condition is good, with little evidence of compaction or churning, no off-road vehicle damage or excessive erosion. Finally physical alterations to the channel and bank have changed the physical patch diversity in the channel itself through reduction in channel sinuosity, reduced pool to riffle ratios, and elevation of the stream bank in many places (Physical Patch Type score D). The total Condition score is an average of these components, a “D” or poor score.

The Camas Creek and Floodplain Wetland Complex Ecological Integrity Assessment score is an average of the Landscape Context, Size and Condition component scores for a final Ecological Integrity score of 2.3, “C” or fair.

Willow scrub-shrub. A recent study (Keigley 2012) attempted to determine if elk browsing or other factors were causing declines in extent and quality of willow habitat (both riparian and scrub-shrub) on the Refuge. However this study is preliminary; quantitative assessment of condition and regeneration is required. Many of the willows on certain sections of the Refuge (e.g., Rays Lake) appear to be dead or dying, while others (e.g., at Two-Way Pond and Camas Creek west of Toomey Pond) appear healthy and vigorous. There are a number of questions to be addressed, including whether the apparently high mortality areas are human-caused, or natural, as there is some indication that coyote willow may be somewhat cyclic and prone to periodic die-offs. Keigley believes that conditions at Rays Lake were once conducive to willow establishment and growth, but that current conditions of flooding alternating with desiccation have killed many willows in this area. Currently the Two-Way/Toomey Pond area provides more stable conditions for willow habitat, and willow in this area is only lightly browsed.

Kittel et al. (2012) found few samples of the Riparian Shrublands Group (USNVC G526 Rocky Mountain and Great Basin Lowland and Foothill Riparian and Seep Shrubland Group) but these were in better condition than their wet meadow neighbors, with three-quarters in excellent to good condition and a quarter in poor condition.

Key Species Supported

As with most wildlife data baselines for Camas NWR, data on wildlife associated with riparian streams and woodland are limited. The best data available on wildlife use of these habitats come from the study of migratory passerine landbirds conducted by Dr. Carlisle of the Idaho Bird Observatory, Boise State University, Boise, Idaho (Carlisle et al. 2008). The results of this study are described in section 4.4.3 below.

A variety of bird species use riparian habitats for foraging and nesting. These include great blue herons, black-crowned night herons, snowy egrets, and great horned owls. The Refuge's dense willow thickets provide both breeding and foraging habitat for migratory landbirds, for example willow and dusky flycatcher, calliope hummingbird, black-billed magpie, and yellow warbler. Riparian habitat provides brood and winter habitat for greater sage-grouse, and willow thickets provide both valuable forage and thermal or security cover for moose and elk.

Terrestrial and semi-aquatic insects also live in willow communities and provide the food base for nesting and migrating songbirds. Although the Refuge's insect community is not well documented, weight gains made by migrating songbirds during their stop-over at Camas (Carlisle et al. 2008) attest to large insect populations in both riparian and shelterbelt habitats.

Native fish in historic Camas Creek were likely limited to cutthroat trout and sculpins (*Cottus* spp.) (Garren 2010). Rainbow trout, brown trout and small- and largemouth bass were introduced in later years, and populations persisted for an unknown number of years. Camas Creek does not currently have suitable habitat to support fish and no fish are known to be present, other than native minnows and suckers.

Refuge Management Activities

All of the Refuge's stream courses have been modified by management activities, but the only physical modifications to any of the streams for wildlife management purposes have been for water diversion to waterfowl ponds, or development of ponds within the channels themselves. In average flow years, the majority of Camas Creek surface waters (58.1 cfs) are diverted from April-July to inundate refuge wetland impoundments. The Refuge can manage for Camas Creek riparian flows below the diversion point for approximately 3-6 weeks, only when flows above 58.1 cfs occur. The Refuge maintains the extent of current willow and shrub habitat where possible, given the constraints of water rights requirements.

Other stream management on the Refuge has been for nonwildlife purposes and has consisted largely of clearing sand, vegetation and debris from the Camas Creek channel by outside, private irrigation interests. Monitoring and control of invasive plants is the only management currently occurring on riparian habitat at Camas NWR. Management of scrub-shrub habitat is discussed in Section 4.3.1 (Wetlands) above.

4.3.3 Sagebrush-Steppe and Grassland Habitats

Overview

Shrub-steppe and semi-desert grassland covers approximately 2,622 acres, or more than 24 percent, of the Refuge and are part of a complex local mosaic of other vegetation community types and ecological sites (Miewald et al. 2012). Sagebrush-steppe habitat has been mapped on about 1,750 acres (16 percent) of the Refuge, green rabbitbrush shrubland (which is considered an early seral stage of the climax sagebrush-steppe community) on 470 acres, and Intermountain Semi-Desert Grassland on 209 acres. The Refuge also contains 191 acres of "ruderal" sagebrush shrubland, that is, a plant community with a sagebrush overstory but an understory dominated by non-native grasses and forbs such that reconstructing the historic vegetation type would be difficult. Another 1,113 acres of the Refuge has been mapped as Upland Non Native habitat, primarily the Crested Wheatgrass Ruderal Grassland Alliance (984 acres). These sites historically would have been sagebrush-steppe and/or semidesert grassland. The findings of the 2012 vegetation mapping project (Miewald et al. 2012) support the findings of Germino et al. (2010), which are summarized below. The “Crested Wheatgrass Ruderal Grassland” corresponds to Germino’s State 3, while the Ruderal Dry Shrubland and Grass groups correspond to State 2.

Refuge sagebrush-steppe habitat is primarily composed of sandy upland ecological sites with 8-12 inches of precipitation, based on USDA, National Resource Conservation Service guidelines, as described by Germino et al. (2010). There are doubtless inclusions of wet meadow and saline wet meadow that are small enough to escape delineation in the general habitat survey and site mapping process. The sandy upland, 8-12 inch site is characterized as follows by the NRCS Technical Guide as follows (in Germino, et al. 2010):

> “The dominant visual aspect of this site is basin big sagebrush and antelope bitterbrush in the overstory with needle and thread in the understory. Composition by weight is approximately 45 to 55 percent shrubs, 5 to 15 percent forbs, and 35 to 45 percent [shrubs].”

The NRCS guide furthers states that there are many possible phases for this site, depending on local natural and anthropogenic influences. The technical guide describes the reference plant community composition as follows:

> “This plant community is dominated by needle and thread, basin big sagebrush, and antelope bitterbrush. Other species that can be significant in the community include Indian ricegrass, sand dropseed, thickspike wheatgrass, western wheatgrass, and arrowleaf balsamroot.”

The designation of reference plant community indicates a plant community in near-pristine condition and at an advanced seral stage. After years of drought and heavy livestock grazing, few sandy upland/sagebrush-steppe sites on the Refuge are in such good condition.

Sandy upland sites are widely distributed across Camas NWR. The heaviest concentration of sagebrush-steppe sites (or potential sites, since many have been converted to grasslands or agricultural fields), tends to be around the perimeter of the Refuge. The sandy upland communities are interspersed with other habitat types; where plant communities are in healthy condition, this creates ecologically valuable ecotones. Key ecological attributes and desired conditions for sagebrush-steppe habitat is shown in Table 4.11 below.

Table 4.11. Key Ecological Attributes, Indicators, and Condition Parameters, Sagebrush Steppe (including other upland vegetation)

Key Ecological Attributes	Indicators	Desired Conditions
Patch Size/Connectivity	Large contiguous tracts.	Tract size >16 ha. (Altman and Holmes 2000; Reynolds et al. 1999)
Hydrology/hydroperiod	Snowpack and precipitation.	Sufficient soil moisture for desired plant growth.
Vegetation diversity and structure	Vigorous and dense growth of native shrubs, forbs and grasses.	Shrub layer cover 5-25%, >80 cm (31 inches) in height; other shrub cover <0%; herbaceous cover 5-0% (Altman and Holmes 2000; Reynolds 1999).

Table 4.11. Key Ecological Attributes, Indicators, and Condition Parameters, Sagebrush Steppe (including other upland vegetation)

Key Ecological Attributes	Indicators	Desired Conditions
		For upland nesting ducks, and other birds, sufficient density to provide cover in patches ≥10 ac. to avoid predators and ≤1 mi from brood habitat.
Forage	Early-mid successional. (moderate-high productivity-low biomass ratio)	Healthy, vigorous shrubs demonstrating ample leader growth. Abundant forbs and grasses filling shrub interstices, as well as providing shrub understory and grassland admixture. Limited dead and decadent components in shrub community. Abundant and diverse terrestrial invertebrates.
Invasive species	Few to no invasive plants present	Little to no cheatgrass, tumble mustard, skeletonweed, knapweed, etc.
Human use	Little to none.	Disturbance during spring and summer limited to necessary habitat manipulation (burning, weed control, fencing); low hunter density at selected sites with sanctuaries available during legal hunting seasons.

Regional Distribution, Conditions, and Trends of Sagebrush-Steppe Habitats

Regionally, threats to sagebrush and other shrub habitats include conversion to agriculture, improper grazing practices, invasive species, increased frequency and severity of fire (exacerbated in part by invasive species such as cheatgrass), and (in certain areas) residential and resort development. In some portions of the Snake River Plain, intervals between fires have increased from decades to every three to five years due to cheatgrass invasion. While cheatgrass is not as abundant in the cooler Eastern Snake River Plain, fire frequencies are nevertheless greater than historical levels. Widespread population and habitat declines have been projected for numerous sagebrush associated species (Knick and Rotenberry 1999, Knick et al. 2003, Wisdom et al. 2000). A growing sense of urgency over the outlook for sagebrush dependent wildlife has spawned numerous assessments and planning exercises at various scales (e.g., Nevada Division of Wildlife [NDOW] 2004; Partners in Flight Conservation Plans; Wisdom et al. 2000; Wisdom et al. 2003a, 2003b). As a result, hundreds of species associated with sagebrush habitats, including 28 species of birds, have been identified as being of conservation concern (Rich et al. 2005; Wisdom et al. 2002).

In their recent range health survey of the Refuge, Germino et al. (2010) reported:

> "Only five of the 24 transects sampled in this habitat had more than 10% cover of sagebrush (transects #32, 33, 35, 48, 45), and - as an example for native bunchgrasses - five others had the needle-and-thread grass (#s 32, 34, 35, 38, and 48). Thus, three of the transects had an abundance of native sagebrush and native bunchgrass that are barely the state 1 condition of this habitat type (#32 with 19-25% cover of each, #35 with 13 and 24% cover, and #48 with 11 and 14% cover). Rabbitbrush, a resprouting shrub that can occur after disturbance but also persists in later successional stages, was a co-dominant in 4 transects (#41, 35, 42, 53). The

> exotic but often desired western wheatgrass was also a co-dominant in 4 transects (#30, 31, 45, 51).
>
> "Overall transects combined, cover of this habitat type was 17.5% crested wheatgrass (I), about 9% each of cheatgrass (I), needle and thread grass, and rabbitbrush; nearly 7% each of sagebrush and western wheatgrass; 4-5% of tumble mustard (I) and madwort (I); and 2-4% of skeletonweed (I), prickly lettuce (I), povertyweed (I), scurf-pea, clover (I), and prickly pear cactus. [Note: I=introduced species]
>
> "The floristics of this habitat type at Camas NWR, for all transects combined, was a blend of the three states in decreasing order of dominance:
> 1) an irreversible transition to **state 3** dominated by seeded species (crested wheatgrass, which may or may not have been seeded on site),
> 2) **state 2**, annual exotics of cheatgrass, tumble mustard, skeletonweed, and clover, and
> 3) **state 1**, shrubs and grasses. For state 1, there was no bitterbrush, yet this species should codominate the site with sagebrush and wheat grasses (needle and thread, thickspike, western) in the absence of fire and improper grazing. According to the NRCS (Appendix 4), frequent fire or improper grazing push the site to state 2, dominated by exotic annuals."

In summary, Germino found that all of the habitats, or ecological sites, his team sampled at Camas NWR had examples of "moderate to extreme condition of degradation." These degraded areas were often characterized by high percentages of exotic, invasive plants. However, he also stated that the sandy upland habitats were the only sites where a majority of the sampling transects revealed healthy plant communities, or communities in "none-to-slight departure" class. While the Refuge's sagebrush-steppe sites certainly did not contain pristine plant communities, they were generally in better condition than the other ecological site types.

The recent vegetation mapping and Ecological Integrity Assessments (Kittel et al. 2012; Miewald et al. 2012) confirm Germino's findings but provide a more nuanced picture of the Refuge's upland habitats. Kittel et al. assessed the ecological integrity of 34 upland sites. Metrics for assessing ecological integrity of upland sites included relative cover or native and non-native plant species, vegetation composition (species composition and diversity), soil surface condition, patch diversity, native bunchgrass abundance, biological soil crust, and fire sensitive shrub composition.

Seventy-four percent of the Refuge's upland sites (25 sites) ranked fair to poor, with most of these (22 sites) ranking in the "poor" category. Many of the lowest ranked sites had undergone complete type conversion to crested wheatgrass, a non-native grass planted to prevent soil erosion. However about one-third of the sites (nine sites; 27 percent) ranked excellent to good. Overall, 26 of the 34 sites were native habitat types (sagebrush-steppe, rabbitbrush shrubland, and desert grassland) while 18 sites had undergone type conversion to ruderal dry shrubland (e.g., sagebrush-steppe with an understory of non-native grasses) and/or crested wheatgrass. While many areas of sagebrush-steppe and rabbitbrush shrubland had an understory of non-native grasses, relatively weed-free examples of sagebrush-steppe and desert grassland ("Good" condition) occurred in the west side and southeast corner of the Refuge. The single "excellent" example was southeast of Sandhole Lake. The "Good" and Excellent" ranked sites can be used as reference sites for these habitats on the Refuge.

Southeastern Idaho, including Camas NWR, provides important habitat for sage grouse and other sagebrush obligate and facultative species. Threats to these species include:

- Loss, degradation, or fragmentation of sage-steppe habitats.
- Development of sage-steppe and allied habitats to less suitable or unsuitable agricultural habitats.
- Additional regional demands on surface and groundwater.
- Wildlife diseases (especially Highly Pathenogenic Avian Influenza H5N1 and West Nile Virus).
- Invasive and noxious weeds, which compete with or exclude desirable plant communities used by sage grouse and the suite of other sagebrush-dependent species.
- Degradation of ecological integrity and function of breeding and foraging habitats for sage-steppe user species via invasive, exotic plants and animals and climatic change.

Key Species Supported

The refuge sagelands provide habitat for a diverse array birds, mammals, reptiles, and amphibians. Of the 117 bird species known to occur at Camas NWR, 22 species typically use sagebrush-steppe habitat. Sagebrush-steppe provides both breeding and foraging habitat for greater sage-grouse, sage thrasher, Brewer’s sparrow, and loggerhead shrike. When close to water, sagebrush provides breeding habitat for long-billed curlew and northern pintail. The birds found in refuge sagebrush-steppe habitat include:

- Greater sage grouse *Centrocercus urophasianus*
- Long-billed curlew *Numenius americanus*
- Short-eared owl *Asio flammeus*
- Burrowing owl *Athene cunicularia*
- Golden eagle *Aquila chrysaetos*
- Ferruginous hawk *Buteo regalis*
- Prairie falcon *Falco mexicanus*
- Swainson’s hawk *Buteo swainsoni*
- Turkey vulture *Cathartes aura*
- American kestrel *Falco sparverius*
- Grasshopper sparrow *Ammodramus savannarum*
- Northern flicker *Colaptes auratus*
- Loggerhead shrike *Lanius ludovicianus*
- Western kingbird *Tyrannus verticalis*
- Eastern kingbird *Tyrannus tyrannus*
- Horned lark *Eremophila alpestris*
- Rock wren *Salpinctes obsoletus*
- Sage sparrow *Amphispiza belli*
- Brewer’s sparrow *Spizella breweri*
- Vesper sparrow *Pooecetes gramineus*
- Lark sparrow *Chondestes grammacus*
- Western meadowlark *Sturnella neglecta*

The majority of these species are known or suspected to breed on the Refuge.

Although less diverse than birds, at least 20 species of mammals occur in the Refuge’s sage-steppe habitat, including elk, mule deer, pronghorn, coyote, badger, sagebrush vole, Idaho pocket gopher, black-tailed and white-tailed jackrabbits (*Lepus californicus*, *townsendii*), mountain cottontail (*Sylvilagus nuttalli*), pygmy rabbit (*Brachylagus idahoensis*), Great Basin ground squirrel (*Spermophilus mollis idahoensis*), Wyoming ground squirrel (*Spermophilus elegans*), Townsend's ground squirrel (*Spermophilus townsendii*), Ord's kangaroo rat (*Dipodomys ordii*), and Merriam's shrew (*Sorex merriami*).

A subset of the herpetofauna reasonably expected to be encountered within the sagebrush-steppe of the lower Camas Creek floodplain consists of: common sagebrush lizard (*Sceloporus graciosus*), greater short-horned lizard (*Phrynosoma douglassi*),western rattlesnake (*Crotalis viridus*), gopher snake (*Pituophis catenifer*), racer (*Coluber constrictor*), terrestrial garter snake (*Thamnophis elegans*), Great Basin spadefoot toad (*Spea intermontanus*), and western toad (*Bufo boreas*).

There are no known checklists of Camas NWR invertebrates. We recognize that these species are important ecologically and more invertebrate data are critically needed.

Refuge Management Activities

Sagebrush-steppe is a critical element to fulfilling all life history elements for many sage-steppe dependent wildlife species (e.g., sage-grouse) and certain life history elements for some wetland dependent wildlife species. While it is assumed that off-refuge habitats on adjacent private lands aid in supplementing this important habitat type, it is also important to note that much of the adjacent habitat is so significantly degraded as to diminish or negate its value for nesting wildlife. Consequently, refuge upland habitats are managed to provide the best vegetative composition, physiological condition and production possible. Control of invasive and noxious weeds is the primary management activity occurring in upland habitats. Refuge upland habitats are also managed consistent with a natural periodicity of ecological disturbance (e.g., fire) through artificial management techniques (prescribed fire). Concurrently, refuge management attempts to be consistent with a natural pattern of wetland and upland habitat interspersion to maximize ecotonal values, thereby fulfilling the greatest number of life cycle requirements for the largest number of wildlife species. To date, a limited amount of sagebrush-steppe habitat restoration (approximately 30 acres, with 113 acres of restoration planned) has been conducted on the Refuge.

4.3.4 Agriculture (Hay Meadows and Crop Fields)

Overview

Currently approximately 160 acres of the Refuge are farmed via Cooperative Land Management Agreements (CLMAs) with local farmers, with up to 140 acres of alfalfa and 20 acres of small grains (winter wheat or barley) planted annually. 150 acres of formerly farmed lands which were allowed to revert to non-native grassland are currently managed as hay fields, also under CLMAs. These agricultural habitats constitute a small percentage of refuge lands but serve a critical function for migratory waterfowl and landbirds, and breeding Canada geese and sandhill cranes. At a point where carbohydrates are required for migration, species such as Canada geese, greater sandhill cranes, and dabbling ducks can find abundant grain to fulfill this life history requirement. Additional benefits are provided for spring/summer browsing by geese and cranes as new growth shoots become available. Considering recent off-refuge conversions from small grain to alfalfa and potato production, refuge grain crops provide a necessary supplement as well as a depredation-relief benefit to those local farmers still growing small grain crops.

One purpose for establishing Camas NWR was to provide migration and breeding habitat for waterfowl, especially Canada geese. Additionally, the Refuge is identified within the Flyway goose management plan for its role in attracting and supporting breeding Canada geese. To meet these goals, a primary strategy is managing short pastures or grasslands. Migrating geese frequently browse upon large, short-grass pastures. These conditions afford the geese access to young green plants and forbs, improved sight distances for predator detection, reduced concealment cover for predators, and clear flight paths for escape.

Most of the Refuge's hay units have had a farming history. By 1947, 240 acres of the Refuge were being farmed for grain production. The intensity of the refuge farming program increased in the 1950s. In 1950, 160 acres of new ground were broken for grain production. By the mid to late 1960s, approximately 500 acres of land on the Refuge had been leveled to increase the production of small grain crops to support the Animal Damage Control (ADC) program, and the trumpeter swan and whooping crane recovery programs at Red Rock Lakes NWR and Grays Lake NWR in the 1970s. When these programs ended in the mid-1970s Camas NWR scaled back on small grain production. Most grain fields on the Refuge were taken out of production and allowed to revert back to introduced pasture grasses. In most recent history these areas have been hayed through Cooperative Land Management Agreements. Currently, fifteen of the Refuge's nineteen hay units (approximately 150 acres) fall within the "active" wetland category, while four units (approximately 100 acres) are "inactive." The decline in local water flow/supply, including aquifer depletion, has reduced the use of some units for haying, or at least increased the interval, in terms of years, between actual hay harvest, or mowing, in some units. Approximately 150 acres are hayed annually.

As a result of their farming history, the Refuge's hay meadows have large exotic vegetation components of either quackgrass, smooth brome, or both, among other species. Within the Natural Resources Conservation Service's (NRCS's) Ecological Site Classification System, the refuge hay meadows are classified as wet meadow ecological sites (Germino et al. 2010). In the 2009 range health survey of the Refuge, Germino et al. (2010) found that the condition of hay meadows had greatly departed from the expected natural condition. As described by Germino, "Much of the habitat classified as wet meadow at Camas NWR appears to be in the transition from state 2 to 3, or it is in an undescribed state that does not resemble typical wet meadows and instead has early-successional and exotic weedy species of upland habitats." Tables 4.12 and 4.13 (below) describe key ecological attributes and desired conditions for hayfields and croplands managed to benefit waterfowl.

Table 4.12. Key Ecological Attributes, Indicators, and Condition Parameters for Waterfowl—Uplands (including managed hayfields)

Key Ecological Attributes	Indicators	Desired Conditions
Hydrology/hydroperiod	Snowpack and precipitation.	Sufficient soil moisture for desired plant growth.
Vegetation diversity and structure	Vigorous and dense growth of native shrubs, forbs and grasses.	Sufficient density to provide cover for upland nesting ducks, and other birds in patches ≥10 ac to avoid predators and ≤1 mi. from brood habitat.
Forage	Short forbs, short growing grasses, and abundant terrestrial	Early successional (high productivity-low biomass ratio) grasslands; hayed or burned fields ≥20 acres, with monotypic stands for

	invertebrates.	Canada goose forage.
Invasive species	Few to no invasive plants present	Little to no Canada or musk thistle, black henbane, knapweed, spurge, etc.
Human use	Little to none.	Disturbance during spring and summer limited to necessary habitat manipulation (haying, burning, weed control, fencing); low hunter density at selected sites with sanctuaries available during legal hunting seasons.

Table 4.13. Key Ecological Attributes, Indicators, and Condition Parameters for Waterfowl—Crops

Key Ecological Attributes	Indicators	Desired Conditions
Hydrology/hydroperiod	Snowpack and precipitation.	Sufficient soil moisture for desired plant growth but allowing equipment use.
Vegetation diversity and structure	Dependent on species planted. Barley 12-24 in. high at maturity. Native grass and forbs acceptable if ≤25% (Frederickson and Drobney 1979) Grains should be knocked down for 100% use by geese and ducks.	Sufficient yield to provide adequate grain for the number and duration of target species (e.g., 200 Canada geese for 60 days). Target 100% use that growing season.
Invasive species	Few to no invasive plants present	Little to no Canada thistle, musk thistle, knapweed, spurge, etc.
Human use	Much to none.	Restrict human use in fields to necessary field preparation (i.e., discing, seeding) and management (i.e., weed control and mowing for waterfowl use). Do not open to hunting.

Regional Distribution, Conditions, and Trends of Agricultural Lands

As of 2007, 58 percent of the Beaver-Camas watershed (372,704 of 647,255 acres) was shrubland or rangeland; 19 percent (122,552 acres) was grass, pasture or hayland, 15 percent was forest, and 6 percent (39,000 acres) was cropland. The remaining 1 percent was water, wetland, developed, or barren (Idaho NRCS 2007). Approximately 27,710 acres of private lands were in row crops, 11,000 acres of private lands were in grain crops, 64,541 acres of private and 58,011 acres of public land in grass, pasture, and hay. Total irrigated lands in the watershed were 63,500 acres; of this 45 percent was irrigated pasture and 47 percent cultivated cropland. A large majority of the cropland (including extensive sprinkler and surface irrigated small grain, sugar beet, potato, and alfalfa) is located in the southern portion of the watershed, near Hamer and the Camas National Wildlife Refuge. While row crops provide little to no value for wildlife, irrigated pasture, alfalfa, and small grain crops do. Threats to agricultural habitats that provide habitat for migratory birds in the Camas NWR area (both on and off-refuge) include lack of funding, low precipitation, weeds, and off-refuge crop depredation in the Beaver-Camas subbasin.

Key Species Supported

Refuge grain fields provide migrating sandhill cranes and waterfowl (primarily Canada geese and dabbling ducks) with an easily accessible, high-energy food source during late fall and early winter as wetlands freeze up. In spring and summer, geese and cranes forage in grainfields as new growth shoots become available. Legumes (alfalfa) also provide forage for Canada geese and mallards. In fall and winter, greater sage-grouse forage in open grain fields, especially if located near sage-steppe vegetation. Sage-grouse also use alfalfa fields for brood rearing. Long-billed curlews forage for earthworms and other invertebrates in bare fields in early spring immediately after their arrival, when fields are typically melted off but before snow cover is completely gone from grasslands. Likewise, greater sandhill cranes forage for waste grain and invertebrates in bare fields in early spring. Abundant invertebrates (especially earthworms) found in alfalfa fields also attract white-faced ibis. Alfalfa supports an abundant small mammal community that is exploited by various birds of prey, for example Swainson’s hawks. Ungulates, especially Rocky Mountain elk and white-tailed deer, also use the Refuge croplands.

Although their vegetation has departed greatly from historic conditions, the Refuge’s hay meadows serve as valuable habitat for sage grouse broods, sandhill cranes, and long-billed curlews and as a migration stop for other migratory birds. When at peak of flood irrigation, the hay meadows provide good foraging habitat for waterfowl, as well as brood pair establishment areas, due to the abundant food resources available in the form of seeds and invertebrates. As plant phenology progresses, the hay meadows are also attractive to foraging waterfowl because of relatively dense cover. The hay units also support pronghorn, elk, and other refuge ungulates.

Refuge Management Activities

Crops (alfalfa and small grains)

The Refuges uses Cooperative Land Management Agreements (CLMAs) with local farmers to implement the refuge farming program. Under these agreements, cooperators front the cost of small grain operations (e.g., mechanical preparations, watering, seeding, labor costs) in exchange for harvesting a portion of the refuge alfalfa crop. Currently, a total of 160 acres of planted agriculture is provided on the Refuge on two separate 80-acre refuge tracts. The Well #7 Field is an 80-acre tract with irrigation equipment owned entirely by the Refuge. Three units provide 60 acres of irrigated alfalfa and one unit provides 20 acres of small grain (winter wheat or barley) for wildlife use. Crops in the Well #7 Field are rotated between two years of small grain and six-years of alfalfa. The Well #9 Field is the second 80-acre tract, which contains a wheel-line irrigation system owned by the cooperator. The Well #9 Field has not proven to be conducive for growing irrigated small grain, so all 80 acres are currently in alfalfa. Irrigated alfalfa is swathed and baled in late summer with the final timing of the harvest occurring at the discretion of the cooperator, based upon the maturity of the alfalfa. Herbicides are applied on farmed units by refuge personnel through force account refuge funding as needed to control invasive species.

Hay Meadows

Haying is conducted via Cooperative Land Management Agreements (CLMAs) as an alternative to force account farming, fencing and weed control. Ultimately, the Refuge achieves short grass conditions and additional improvements without the cost of performing these activities. In all the Refuge manages up to 250 acres of hayed land, divided into fifteen management units. Of this, 150 acres are hayed annually. Hay units are rotated so that no unit is hayed two years in a row. Refuge fields are hayed after July 15 to avoid conflicts with ground nesting birds.

The hay meadow wetlands of Camas NWR were originally arrayed along Camas Creek, except for units 10a and 10b, which are immediately west and south of Spring Pond. As discussed previously, these meadows would have historically been subject to overbank flows from Camas Creek during the spring, or other flood periods. Since the settlement of the Camas Creek floodplain and the conversion of these meadows to hay production, they have evolved into active and inactive wetlands. “Active” wetlands (meadows) are those that can still be, and are on some schedule irrigated, either for hay production and/or wildlife habitat needs. “Inactive” hay meadows (unit numbers 2a, 2b, 10a, and 10b) are those that either cannot be irrigated due to lack of adequate water supply, water rights, or diversion infrastructure. These are evaluated in the “Inactive Wetland” section above.

There are currently fifteen active hay meadow units at Camas NWR (units 2d-7b), although not all are irrigated or mowed (harvested) every year. They are all palustrine emergent vegetation, with persistent structure and temporary water regimes. Historically these would have been wet meadows, although as noted above they are currently dominated by non-native grasses. Two units, 5g and 5h, were also typed as having seasonal water in some portions.

4.3.5 Cultural Woody Vegetation (Shelterbelt and Non-Native Plantings)

Overview

The Refuge also contains approximately 34 acres (from 2012 vegetation mapping) of cultural woody vegetation, with a significant component of tree and shrub species that are not native to the Camas area. The headquarters patch is multicanopied gallery with stringers of shrubs and shrub-trees radiating out from the main gallery stand, or adjacent to it with no direct, physical connection. Cottonwoods of varying ages from overmature to seedlings, are the dominant structural aspect of the gallery portion of the headquarters stand. The rest of the stand’s components include both native (to Idaho though not necessarily the Snake River Plain) and non-native species. Native species include black cottonwood (*Populus trichocarpa*), peachleaf willow (*Salix amygdaloides*), coyote or narrowleaf willow (*Salix exigua*), and Wood’s rose (*Rosa woodsii*), whereas exotic species include Russian olive (*Elaeagnus angustifolia*), Siberian pea (*Caragana arborescens*), green ash (*Fraxinus pennsylvanica*), box elder (*Acer negundo*), and Plains cottonwood (*Populus deltoides*; also known as eastern and/or American cottonwood). Both box elder and Plains cottonwood are species native to portions of eastern Idaho but likely were not found historically on Camas NWR (Carlisle et al. 2008).

Key Species Supported

Camas NWR’s shelterbelt habitat has been recognized as a migration hotspot for decades, with numerous sightings of birds never previously documented in Idaho. Carlisle et al. (2008) documented an impressive abundance and diversity of spring and autumn migrants using the Refuge’s shelterbelt. Carlisle found that peak migration timing for all species combined occurred between early August and late September during fall migration, and mid-May to early June during spring migration. Seventy-four different songbird species were captured at the Camas NWR headquarters shelterbelt, including Wilson’s warbler, yellow warbler, yellow-rumped warbler, MacGillivray’s warbler, warbling vireo, and western wood-pewee. Moreover, recaptured birds at the site were experiencing substantial weight gain during their stop-over at the Refuge (see Section 4.4.3 below). The Refuge’s shelterbelt also provides breeding habitat for willow flycatcher, dusky flycatcher, and yellow warblers, and foraging habitat for American kestrel and resident landbirds such as downy woodpecker and ruby-crowned kinglet. Refuge shelterbelt provides an important winter roost site for bald eagles. Since 2000, peak counts at the roost site have ranged from 30-40 eagles (see section 4.4.4).

Refuge Management Activities

The Refuge currently pumps groundwater and flood irrigates shelterbelt habitat with existing ditch and water delivery network to maintain 55 acres of shelterbelt habitat. Non-native and/or invasive trees and shrubs (i.e., Russian olive, Siberian pea) have been replaced with plantings of trees and shrubs native to Idaho that provide similar habitat and food values for migratory birds. Cottonwood snags (standing dead trees) and fallen dead limbs are allowed to remain unless they pose an immediate danger to the public or refuge facilities, or inhibit natural or assisted regeneration of young cottonwoods. Many of the large cottonwoods are at the end of their lifespan and in need of replacement. Replacement in some areas has been initiated and is proving to be time, labor and money intensive.

4.4 Major Species Groups

Population data for major species groups (waterfowl, waterbirds, landbirds, and ungulates) or species of concern (bald eagles) are presented in this section. Much of this data has been collected by refuge staff. Data on waterbirds and landbirds was collected and analyzed by the IDFG's Idaho Bird Inventory and Survey (IBIS) Program and the Idaho Bird Observatory.

4.4.1 Waterfowl

Overview

Thousands of waterfowl use the Refuge during spring, summer, and fall. The most abundant species include Great Basin Canada geese, mallard, green-winged teal, canvasback, redhead, and ruddy ducks. Gadwall, northern pintail, cinnamon teal, and lesser scaup also occur in lower numbers. Some snow geese, trumpeter swans, and tundra swans migrate through the Refuge. Several species of duck nest on the Refuge. The most common nesting waterfowl species include gadwall, mallard, canvasback, redhead and ruddy duck. Trumpeter swans, lesser scaup, northern shoveler, cinnamon teal, green-winged teal, northern pintail, and American wigeon also nest in lesser numbers. Data on peak waterfowl numbers and production for the Refuge are summarized below.

The Refuge is a locally important molting area for swans, geese and ducks, although numbers are modest. Sandhole Lake hosts the principal molting concentration, although the more permanent core wetlands also provide molting habitat for smaller numbers of waterfowl.

Great Basin Canada geese are the only breeding goose on the Refuge. Geese arrive in March and depart in November, depending on weather and ice conditions. Arrival and departure trends for migratory waterfowl are not closely monitored and vary annually by species, regional and local weather patterns, and other climatic conditions. Typically the first permanent open water occurs in April, and freeze-up occurs in November. Smaller cadres of Canada geese will normally overwinter in the general area of the Refuge, perhaps roosting on the Henry's Fork of the Snake River, approximately 20 miles to the east.

Condition and Trends

Goose and duck surveys have been conducted by refuge personnel since the 1940s, but waned after the 1980s. Waterfowl populations on Camas NWR have been monitored using several different techniques (aerial surveys, boat based surveys, and ground based surveys) for total count, breeding pair, and brood counts. From review of the Camas NWR annual narrative reports, former refuge biologist Carl Mitchell concluded that the waterfowl count data in the Annual Narrative Reports from 1941 to 1995 are not to be taken at face value. The observations and ‘data’ are very subjective, and were made and recorded inconsistently between managers and years. For example, some managers counted all waterfowl (swans, geese, ducks and coots) while others only estimated one or two species of ducks. In addition, early refuge reports on wildlife were primarily extrapolations based on limited field observations. Assumptions upon which these extrapolations were based could not always be verified. To be fair, this was the standard procedure for that time, and all that was generally possible to do given other refuge management priorities, limited staff and funding, and generally less robust standards for biological data. Therefore these figures do not provide “reliable knowledge” (Romesburg 1981, 1991) and the numbers should be considered to be very rough estimates. However, data from these surveys have been used to assess populations and their response to management actions. Data on waterfowl abundance and production from 1941-1991 are provided in Table 4.14 below. Spring migration peak dates range from 15 March to 20 April. Fall migration peaked between 15 September and 21 December. Figures 4.3 and 4.4 display peak waterfowl data by season. Note that “Zero” values have no estimates recorded for that year.

Duck numbers counted fluctuate widely due to continental, regional, and local environmental, biological, and management effects. Peak counts/estimates on the Refuge during spring migration range from 10,000 to 197,000 birds, and peak fall migrant estimates range from 9,585 to 200,000. Thus density estimates of various species, or their annual production may not be the best metric to monitor management success. From the mid-1960s until the early 1990s when waterfowl surveys ended, peak spring estimates have traditionally run from 10,000 to over 30,000 waterfowl, while fall estimates range from 40,000 to 60,000+ waterfowl.

Canada geese in the Camas NWR and southern Idaho region have shown a significant change in numbers and distribution (Knetter 2009), but little attention has been given to monitoring specific life history parameters because the population is well above objective.

Table 4.14. Spring and Fall Peak Waterfowl Population Estimates and Annual Waterfowl Production Estimates at Camas NWR, Idaho, 1941-1991

Year	Peak Waterfowl Spring Date	Peak Waterfowl Spring Estimates	Estimated Waterfowl Production	Peak Waterfowl Fall Estimates	Peak Waterfowl Fall Date
1941	03/15	13,000		18,500	10/21
1942	04/15	19,000	11,000	22,500	10/01
1943	03/21	75,000	18,000	37,000	10/01
1944	04/01	100,000	16,000	127,500	11/08
1945	03/15	45,000	13,700	120,000	11/10
1946	04/01	175,000	10,600	200,000	
1947	03/15	37,500	7,600	62,500	11/05
1948	03/28	8,000	6,100	100,000	11/01
1949	03/25	10,500	4,500	18,500	09/15

Table 4.14. Spring and Fall Peak Waterfowl Population Estimates and Annual Waterfowl Production Estimates at Camas NWR, Idaho, 1941-1991

Year	Peak Waterfowl Spring Date	Peak Waterfowl Spring Estimates	Estimated Waterfowl Production	Peak Waterfowl Fall Estimates	Peak Waterfowl Fall Date
1950	04/01	10,500	3,300	61,000	10/26
1951		48,500	5,432	70,000	11/06
1952	03/05	45,700	5,240	52,631	10/20
1953	04/20	70,000		29,720	10/21
1954		55,500	2,732	28,400	11/15
1955	04/01	38,400	2,930	26,125	11/15
1956	04/01	17,240	1,165	23,520	11/07
1957	04/01	14,125	1,100	32,395	11/09
1958	03/29	17,650	1,265	33,380	11/15
1959	03/31	19,000	905	20,450	10/23
1960		13,504	1,445	16,380	11/01
1961	04/01	16,050	1,581	17,900	10/21
1962		10,470	3,930	9,585	12/01
1963	04/01	24,000	3,143	11,085	
1964			4,055	75,840	11/11
1965	04/07	64,275	2,270	112,650	11/21
1966	04/06	48,030	2,500	48,850	11/15
1967	04/28	52,250	3,065	138,070	11/07
1968	03/27	102,915	3,375	40,475	12/21
1969			3,660		
1970			4,650		
1971			2,620		
1972	04/15	34,310	1,233	54,940	10/01
1973			3,665		
1974			4,510		
1975			6,335		
1976			3,050		
1977			2,200		
1978			4,410		
1979		197,000	2,575		
1980			6,650		
1981			8,765		
1982		25,000	6,330		
1983			5,335		
1984			4,315		
1985			5,010		
1986			6,295		
1987		20,000	4,000		
1988			1,785		
1989			1,835		
1990			1,980		
1991		10,000	1,760	65,000	

Source: Refuge Annual Narrative Reports

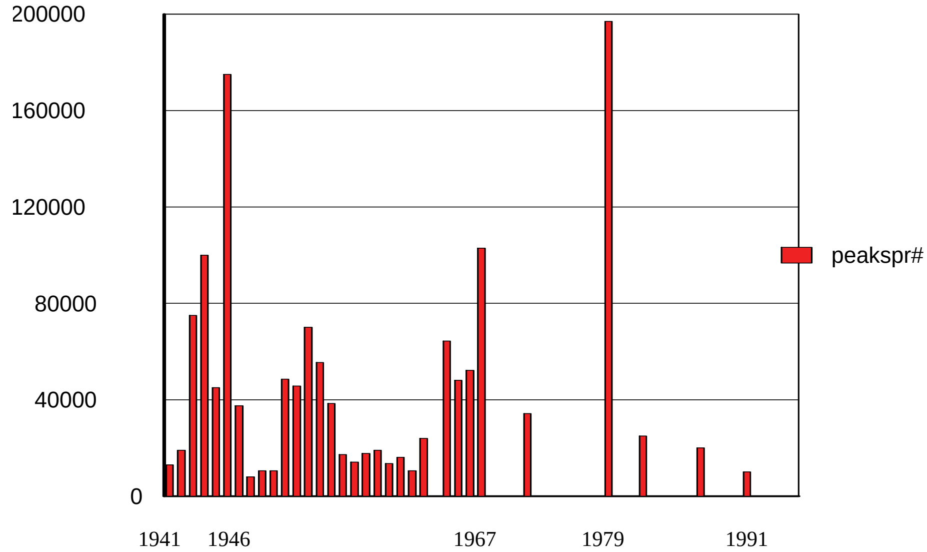

Figure 4.3. Peak spring waterfowl migration counts at Camas NWR, 1941-1991. (Source: Refuge Annual Narrative Reports)

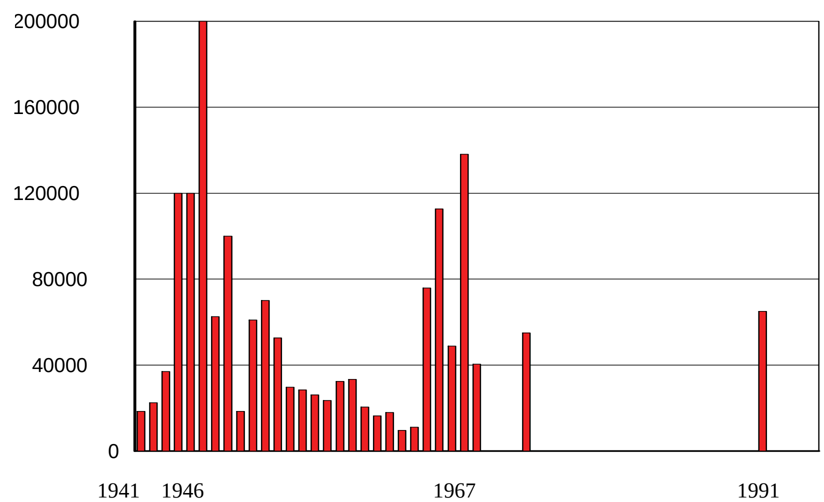

Figure 4.4. Peak fall waterfowl migration counts at Camas NWR, 1941-1991. (Source: Refuge Annual Narrative Reports)

Waterfowl Production

In the past, aerial surveys, boat based surveys, and ground based surveys have been used to obtain breeding pair and brood counts. Some of this variation is due to interest, technique, visibility, and whether all waterfowl, or just ducks, were tallied. In 2005-2006, total counts, breeding pairs and brood counts were obtained using ground counts. Some additional, selected counts were conducted in 2007, 2009, and 2010. Recent research suggests the ground counting technique currently employed involves significant sampling bias, which limits its value to managers (see section 4.7, Wildlife and Habitat Monitoring and Research Efforts).

According to recent waterfowl surveys and Annual Narrative Report data (Figure 4.5), annual waterfowl productivity is, and has always been, highly variable at Camas NWR. Production estimates between 1941 and 1991 ranged from 905 to 18,000. Annual productivity is based largely on water conditions on the Refuge and in the immediate vicinity. In wet years wetlands are fairly abundant around the Refuge, and waterfowl scatter to exploit local available habitats. In dry years breeding waterfowl concentrate on the Refuge and nearby, State wildlife management areas. Due to study design and limited staff time for surveys, nest success has not actually been calculated, but is assumed to also vary widely, as does brood survival. Inclement weather at high elevations, in addition to the usual perils of predation, water and forage abundance, often drastically reduces cygnet, gosling, and duckling survival. Some variation is also due to survey effort and technique, and observer experience. Most ground-based survey techniques tested show high levels of variation in sample data.

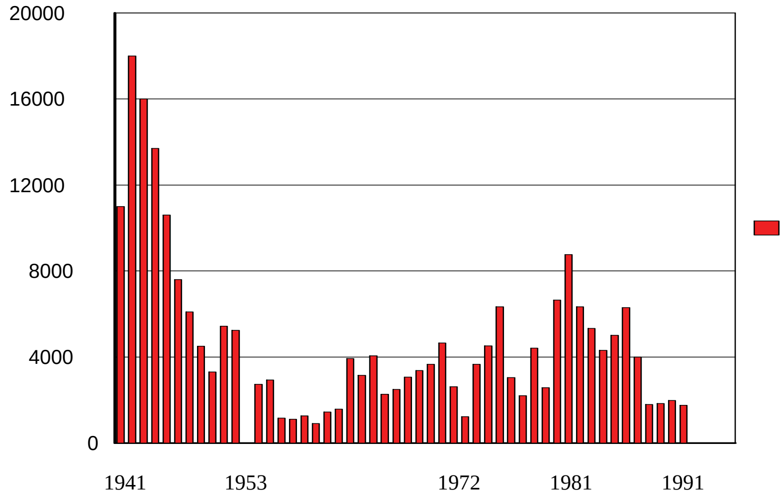

Figure 4.5. Waterfowl production at Camas NWR, 1941-1991.
(Source: Refuge Annual Narrative Reports)

Threats to Waterfowl

Southern Idaho, including Camas NWR, provides important habitat for migrating and breeding waterfowl using the Pacific Flyway, and to colonial waterbirds. Threats associated with breeding and migration areas in Canada and Alaska are treated in detail in other documents. Threats to waterfowl and their associated habitats in this region include:

- Loss, degradation, or fragmentation of wetland and grassland habitat.
- Development of grasslands or conversion to less suitable or unsuitable agricultural habitats.
- Additional regional demands on surface and groundwater.
- Wildlife diseases (especially Highly Pathenogenic Avian Influenza H5N1 and West Nile Virus).
- Invasive and noxious weeds, which compete with or exclude desirable grasses and forbs used by waterfowl and compromise ecological integrity and function.

4.4.2 Colonial Nesting Waterbirds and Other Waterbirds

Overview

Camas NWR hosts significant numbers of and diversity of waterbirds. The most notable species include sandhill cranes, white-faced ibis, Franklin's gulls, California gulls, pied-billed grebes, eared grebes, western grebes, Clark's grebes, white pelicans, double-crested cormorants, great blue herons, black-crowned night herons, snowy egrets, cattle egrets, Forster's terns, Caspian terns, black terns, American bitterns, American coots, sora rails, Virginia rails, and Wilson's snipe. The presence of a diverse and abundant suite of waterbirds makes this Refuge critical for their local conservation.

Waterbirds use almost the entire range of habitats at Camas NWR, with the exception of shrub-steppe. Use concentrates in various wetland types, but species also use riparian vegetation (e.g., nesting herons) and croplands (e.g., foraging sandhill cranes, white-faced ibis, and long-billed curlew). The summaries of each unit provided above also serve to describe habitats for most waterbirds.

Condition and Trends

Early marshbird or waterbird surveys were crude estimates usually based on guesswork, but sometimes augmented by ground or aerial surveys. Therefore, undue reliance on the actual numbers reported in Camas NWR Annual Narrative reports is not warranted. Effort on individual species also varied with staff and other duties, so not all species were mentioned, let alone surveyed, each year.

In 2005, the Southeast Idaho National Wildlife Refuge Complex began cooperating with IDFG's Idaho Bird Inventory and Survey (IBIS) Program (Moulton and Sallabanks 2006). All data are taken from Moulton and Sallabanks 2006; Moulton 2007, 2008, 2009, 2010).

Secretive Marsh Bird Playback Surveys

Secretive Marsh Bird Playback Surveys are based on procedures outlined by Conway (2005). In 2005, these surveys detected four the five target species (sora rail, Virginia rail, American bittern, coot, pied-billed grebe) at sixteen points (8 a.m., 8 p.m.) on three surveys. Only American bittern was not detected at Camas NWR. They found a mean of 1.08 birds/point/survey detected on morning surveys, and one bird/point/survey detected on evening surveys.

American coots were abundant at all locations, and were difficult to track individually during surveys. This species is generally detected quite well during monthly aquatic bird surveys. Thus coots were dropped from these surveys, and Wilson's snipe (*Gallinago delicata*) added. Wilson's snipe is another secretive marsh bird species that is not readily detected visually during aquatic bird surveys.

During 2006 Secretive Marsh Bird Playback Surveys IBIS crews detected all of the five target species (sora rail, Virginia rail, American bittern, pied-billed grebe, and Wilson's snipe) on 28 points (14 a.m., 14 p.m.) on four surveys at Camas NWR. They detected 2.77 birds/point/survey on morning surveys, and 3.05 birds/point/survey on evening surveys. Of the ten secondary species (coot *Fulica americana*, brown-headed cowbird *Molothrus ater*, common yellowthroat *Geothlypis trichas*, eared grebe *Podiceps nigricollis*, marsh wren *Cistothorus palustris*, red-winged blackbird *Agelaius phoeniceus*, willow flycatcher *Empidonax traillii*, yellow-breasted chat *Icteria virens*, yellow-headed blackbird *Xanthocephalus xanthocephalus*, and yellow warbler *Dendroica petechia*), all, except the willow flycatcher and yellow-breasted chat were detected, for an 80 percent success rate at the Refuge.

The 2007 Marsh Bird Playback Surveys were again successful in detecting all target species (sora rail, Virginia rail, American bittern, pied-billed grebe, Wilson's snipe) at Camas Refuge. As in 2006, all secondary species except willow flycatcher and yellow breasted chat were also detected. Similar to the aquatic bird surveys, these surveys represented the completion of a three-year inventory period.

Secretive Marshbird Playback Surveys were not conducted at Camas NWR in 2008, due to the IBIS program's necessity of expanding sampling to new areas. For 2009, Secretive Marshbird Playback Surveys for six points on three surveys detected 1.44 birds/point/survey. That included all five primary species (sora rail, Virginia rail, American bittern, pied-billed grebe, and Wilson's snipe). The secondary species list had substantially changed and now consists of American coot, marsh wren, yellow-headed blackbird, Clark's grebe *Aechmophorus clarkii*, western grebe *Aechmophorus occidentalis*, Forster's tern *Sterna forsteri*, long-billed curlew *Numenius americanus,* black tern *Chlidonias niger*, and red-necked grebe *Podiceps grisegena*). Species counted dropped from a total of ten species in 2007 to nine. Of this new secondary list, only 56 percent, or five species (American coot, long-billed curlew, marsh wren, western grebe and yellow-headed blackbird) were detected. The results of the 2010 Secretive Marsh Bird Playback Surveys are not available at this writing.

Colonial Waterbird Counts

Historically many of the waterbird species of Camas NWR nested colonially. These species included great blue heron, black-crowned night heron, California gulls, Franklin's gulls, white-faced ibis, and eared grebes. Colonial nesting has been in long term decline on the Refuge due to declining water conditions and shrinking wetland habitat. IBIS surveys during 2005 through 2010, extensive waterfowl surveys in 2005 and 2006, and casual observation by the refuge staff detected no colonial nesting. Refuge staff discovered small colonies of white-faced ibis and Franklin's gulls in 2012. Colonial nesting birds are therefore expected to use the Refuge sporadically and opportunistically based on water and vegetation conditions.

Aquatic Waterbird Surveys

In 2005, 2006, and 2007, IDFG also conducted Aquatic Waterbird Surveys, as recommended by the Intermountain West Waterbird Conservation Plan. These consisted of actual counts from specific sites, in order to illustrate species occurrence, relative density, and diversity through time. This inventory period provided a useful baseline of aquatic bird use at these sites.

Aquatic Waterbird Surveys were conducted in May, June, and July in 2005; April, May, June, and July in 2006 and 2007. In 2005, waterfowl species totaled seventeen, seventeen, and sixteen, for those months, respectively. Shorebird species totaled five, six, and five, respectively, and waterbird species totaled nine, eleven, and fifteen. In 2006, waterfowl species totaled 20, 20, nineteen, and nineteen, for those months, respectively. Shorebird species totaled five, twelve, nine, and thirteen respectively, and waterbird species totaled twelve, 21, 21, and 20. In 2007, Aquatic Bird Surveys detected seventeen, 20, seventeen, and seventeen waterfowl species in April, May, June and July, respectively. Shorebird species totaled six, nine, seven, and nine, and other waterbirds twelve, fourteen, thirteen, and eleven species, respectively.

Threats to Waterbirds

Southeastern Idaho and the Refuge also provide important habitat for breeding waterbirds in the Great Basin and Pacific Flyway. Other threats are associated with breeding and migration areas in Canada and Alaska, and are treated in detail in other documents. Threats to waterbirds and their associated habitats in this region include:

- Loss, degradation, or fragmentation of wetland habitats.
- Development of wet meadows and shallow wetlands to less suitable or unsuitable agricultural habitats.
- Additional regional demands on surface and groundwater.
- Wildlife diseases (especially Highly Pathogenic Avian Influenza H5N1 and West Nile Virus).
- Invasive and noxious weeds, which compete with or exclude desirable plant communities used by waterbirds, and which and compromise ecological integrity and function of their breeding and foraging habitats.
- Conflicts, real or imagined, between desirable sport fisheries and piscivorous birds.
- Human disturbance to key foraging and roosting areas.

4.4.3 Migratory Landbirds

Overview

Although the work of Carlisle et al. (2008) focused mainly on the gallery forest around and adjacent to refuge headquarters, migratory landbirds probably use the entire range of woody riparian habitats at Camas NWR. These species use the various woody riparian habitats for both migrant and resident purposes. The vast majority of individual landbirds are migrants and gain nutrients and shelter from the Refuge's stream courses, groves, and thickets. However, an appreciable number of them are also nesting and fledging young at Camas NWR. One of the most important data sets from the migratory landbird project was the quantification of the fat reserves landbirds were able to achieve and maintain at the Refuge (Table 4.15). The superior body fat reserves that both transitory and resident landbirds generally demonstrated at Camas NWR theoretically reflect superior habitat availability at the Refuge (Carlisle et al. 2008). Intuitively the Refuge's woody habitats appear to be providing particularly good foraging opportunities, but the shelter/cover aspects of the local woody riparian habitat cover quality may also be a factor. Superior refuge woody riparian structure, possibly due to woody riparian species composition and/or condition, may be contributing to good passerine condition via reduced exposure to climatic elements and predation.

Condition and Trends

From 2005 through 2007, Dr. Carlisle and his field crew conducted extensive banding operations in and around the refuge headquarters and all data are taken from Carlisle et al. 2005a,b, 2008.

Songbird Mist Netting Surveys

Songbird mist netting surveys procedures used in the project are described by Carlisle (2005a,b, 2006, and 2008).

In 2005 a fall survey was conducted. The most commonly captured species were Wilson's warbler (1,841), ruby-crowned kinglet (423), orange-crowned warbler (337), MacGillivray's warbler (239), yellow warbler (158), hermit thrush (131), dark-eyed junco (120), Hammond's flycatcher (119), and white-crowned sparrow (102) on 86 days over a total of approximately 4,021 net hours. The overall capture rate was 1.106 birds/net hour for 4,446 songbirds of 71 species, a particularly high species richness.During 2006, Songbird Mist Netting Surveys operated on 60 days in both spring and fall. These efforts totaled approximately 2,581 mist net hours. 2,322 birds of 73 different species were captured yielding an overall capture rate of 0.90 birds/mist net hour. Hermit thrush (348), Wilson's warbler (280), ruby-crowned kinglet (220), western tanager (201), MacGillivray's warbler (135), Swainson's thrush (118), dusky flycatcher (105), yellow warbler (97), American robin (96), and willow flycatcher (68). Rare species captured in spring 2006 included ovenbird (four), black-throated gray warbler (two), Virginia's warbler (one), and common grackle (three).

The 2007 Camas NWR Songbird Mist Netting Surveys were again both a spring and fall operation. Mist nets were open on 60 different days for a total of 2,868.5 mist net hours. 1,891 birds of 56 different species were captured for an overall capture rate of 0.66 birds/mist net hour. The most frequently captured species were hermit thrush *Catharus guttatus* (376), Wilson's warbler *Wilsonia pusilla* (257), Swainson's thrush *Catharus ustulatus* (191), MacGillivray's warbler *Oporornis tolmiei* (142), dusky flycatcher *Empidonax oberholseri* (137), yellow warbler *Dendroica petechia* (86), ruby-crowned kinglet *Regulus caledula* (79), American robin *Turdus migratorious* (73), willow flycatcher *Empidonax traillii* (73), and western tanager *Piranga ludoviciana* (59).

Point Count Surveys

Songbird point count surveys procedures used in the project are described by Carlisle (2005a,b, 2006, 2008). The 2005 Camas NWR point count survey was executed from July through October and produced 76 avian species of 2,696 individuals. The most abundant species were European starling (*Sturnus vulgaris*), Wilson's warbler, yellow-rumped warbler (*Dendroica coronata*), American robin, ruby-crowned kinglet, black-billed magpie (*Pica hudsonia*), dark-eyed junco (*Junco hyemalis*), chipping sparrow (*Spizella passerina*), yellow warbler, and Brewer's blackbird (*Euphagus cyanocephalus*).

A spring survey was added to the 2006 Camas NWR point count and the summer-fall study started in 2005 was also rerun. The two counts produced 65 avian species of 1,749 individuals. The most abundant species were mourning dove (*Zenaida macroura*), European starling, American robin, yellow warbler, American kestrel (*Falco sparverius*), and Brewer's blackbird.

The 2007 refuge point counts detected 65 species of 1,626 individuals. The most abundant species were European starling, American robin, mourning dove, Wilson's warbler, yellow warbler, Brewer's blackbird, Bullock's oriole (*Icterus bullockii*), western kingbird (*Tyrannus verticalis*), black-billed magpie, brown-headed cowbird (*Molothrus ater*), and American kestrel.

Table 4.15. Weight gain by migratory landbirds during stop-over at Camas NWR, spring migration (2005, 2006) and fall migration (2006, 2007).

Table 5. Annual comparison of stopover ecology data for migrants at Camas NWR with ≥ 5 recaptures in each season/year combination; 2005-2007. Minimum stopover duration is the number of days elapsed between first and last capture, and mass change reflects the total change in mass of this time interval. Values are mean ± SE with sample size (*n*) in parentheses. Scientific names for all species are provided in Table 1. Asterisks indicate the level of significance such that * = $P < 0.05$, ** = $P < 0.001$ and marginally significant differences ($P < 0.10$) are indicated by the symbol §.

FALL MIGRATION	2005			2006		
	stopover duration (*n*)	mass change	change per day	stopover duration (*n*)	mass change	change per day
Hammond's Flycatcher	2.00 ± 0.27 (8)	0.25 ± 0.34	0.12 ± 0.14	2.17 ± 0.54 (6)	0.23 ± 0.24	-0.005 ± 0.15
Warbling Vireo	1.50 ± 0.22 (6)	0.39 ± 0.19*	0.29 ± 0.17*	2.80 ± 0.49 (10)*	-0.34 ± 0.14	-0.08 ± 0.04
Ruby-crowned Kinglet	2.20 ± 0.23 (44)	0.15 ± 0.07	0.02 ± 0.03	2.16 ± 0.18 (50)	0.04 ± 0.05	0.00 ± 0.02
Hermit Thrush	2.89 ± 0.76 (18)	0.68 ± 0.27	0.19 ± 0.15	3.21 ± 0.48 (28)	0.39 ± 0.22	0.05 ± 0.06
Orange-crowned Warbler	2.15 ± 0.42 (13)	0.57 ± 0.18*	0.31 ± 0.04**	1.17 ± 0.17 (6)	-0.16 ± 0.08	-0.13 ± 0.06
Yellow Warbler	3.00 ± 0.44 (12)	-0.004 ± 0.14	-0.02 ± 0.06	2.38 ± 0.43 (13)	0.12 ± 0.18	0.06 ± 0.06
MacGillivray's Warbler	2.90 ± 0.32 (50)	0.45 ± 0.10	0.14 ± 0.04	2.89 ± 0.30 (36)	0.66 ± 0.15	0.20 ± 0.04
Wilson's Warbler	2.18 ± 0.12 (203)*	0.22 ± 0.03**	0.08 ± 0.01**	1.72 ± 0.10 (102)	0.06 ± 0.04	0.01 ± 0.02
Dark-eyed Junco	7.14 ± 2.39 (7)	0.44 ± 0.44	-0.11 ± 0.16	3.08 ± 0.58 (12)	-0.001 ± 0.17	-0.09 ± 0.12

SPRING MIGRATION	2006			2007		
	stopover duration (*n*)	mass change	change per day	stopover duration (*n*)	mass change	change per day
Ruby-crowned Kinglet	2.50 ± 0.37 (20)	0.15 ± 0.05	0.08 ± 0.03	1.00 ± 0.00 (5)§	0.17 ± 0.06	0.17 ± 0.06
Hermit Thrush	2.08 ± 0.42 (12)	0.32 ± 0.17	0.12 ± 0.13	2.33 ± 0.56 (6)	0.19 ± 0.23	0.02 ± 0.12
Swainson's Thrush	2.46 ± 0.43 (11)	-0.63 ± 0.45	-0.55 ± 0.36	1.27 ± 0.14 (11)	-0.05 ± 0.22	-0.01 ± 0.21
MacGillivray's Warbler	3.00 ± 0.99 (14)	0.50 ± 0.12	0.20 ± 0.08	3.80 ± 1.62 (10)	0.76 ± 0.34	0.29 ± 0.14
Wilson's Warbler	1.37 ± 0.14 (27)	0.35 ± 0.07	0.24 ± 0.04	1.78 ± 0.26 (27)	0.24 ± 0.06	0.15 ± 0.04

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From Carlisle et al. 2008.

4.4.4 Bald Eagles

Overview

Another species associated with woody riparian habitat on the Refuge, particularly the gallery forest at headquarters, is the bald eagle (*Haliaeetus leucocephalus*). There is some sporadic bald eagle use of the Refuge for hunting or scavenging purposes, but the primary value of Camas NWR habitats to the species is as a roost site. That life cycle need is provided by the woody riparian habitat type, specifically the multi-canopy grove of mature cottonwood at the refuge headquarters. The upper canopy is the important facet in terms of eagle roosting.

Condition and Trends

Upward of 40 bald eagles use the headquarters cottonwood stand as a roost in recent years. Since 2000, the average peak number of bald eagles observed at the headquarters stand has ranged from 32 to a peak of 48 eagles in 2008 (Table 4.16). The birds' use of the Refuge varies from year to year, depending on such variables as weather and prey populations. Eagles they generally begin arriving at Camas in November, or December, and the last bird has departed normally by mid-late April. Early arrivals may actually be using the Refuge to hunt, or scavenge, on waterfowl or small mammals, but as the population builds later in the winter the refuge water has frozen, forcing most waterfowl to leave and significantly reducing on-refuge foraging opportunities for bald eagles. Similarly, there is very limited upland game hunting on Camas NWR and no big game hunting, so scavenging opportunities for hunter-lost or wounded nonwaterfowl species are essentially nonexistent. Currently the Camas fishery is also very small, both in population and physical stature, and does not provide much potential eagle forage in terms of winter-killed suckers or minnows. Consequently, bald eagles use Camas NWR primarily for roosting, and hunt or scavenge off-Refuge.

The eagles have been roosting in the refuge trees for many years and have been reported to have historically used the Refuge for hunting or scavenging. Numbers of eagles present fluctuated widely and the data prior to 1994 must be viewed cautiously, as observations and reports apparently followed only a general pattern, rather than actual protocol. The refuge manager during the 1970s and 1980s characterized the Camas bald eagle peak as "normally 10-30" birds (1991 Refuge Annual Narrative Report).

He does mention a significant population spike of 80-85 bald eagles during 1983-1985 and attributes this to an irruption of black-tailed jackrabbit (*Lepus californicus*) locally. Richardson further states in several refuge annual narratives that the eagles were foraging on the Refuge and specifically taking advantage of large winterkills of native suckers in Camas Creek and some tributary wetland basins. Bald eagle peaks on Camas NWR for 1978 through 1993, taken from the annual narrative reports, are presented in Table 4.17. These data, again, are useful only in the context of a crude portrayal of the eagle population present on the Refuge. In some cases there is difficulty in interpreting the figures presented in the narrative reports due to uncertainty as to when birds were counted and whether the survey was of birds on the roost, or elsewhere on the Refuge, perched, hunting, or flying in transit. The overall picture presented by these data of an area with long-term presence of, and use by, bald eagles is nonetheless, useful and important. The very high counts (80-85 individuals) of 1983-1985 are not used in comparisons due to uncertainty as to whether those figures reflect birds at roost, or off-roost hunting on the Refuge. Peak eagle numbers at the headquarters roost between 1978 and 1993 (16 years) ranged from five to 31, and averaged eighteen.

Table 4.16. Recent Bald Eagle Roost Peak Counts, Camas NWR

Date	Peak Count
2010	
2009	
2008	48
2007	39
2006	47
2005	32
2004	
2003	35
2002	
2001	
2000	
1999	
1998	
1997	
1996	
1995	27
1994	17

Source: Refuge Annual Narrative Reports.

Table 4.17. Historical Bald Eagle Roost Peak Counts, Camas NWR

Date	Peak Count
1993	12
1992	9
1991	13
1990	10
1989	12
1988	12
1987	17
1986	15
1985	(80-85)
1984	(80-85)
1983	26
1982	31
1981	10
1980	5
1979	Unknown
1978	7

Source: Refuge Annual Narrative Reports.

4.4.5 Ungulates (Deer, Elk, Pronghorn, and Moose)

Condition and Trends

Five ungulate species occur on the Refuge: elk, moose, mule deer, white-tailed deer, and pronghorn. As shown in Table 4.18 below, populations and densities of these five species have been highly variable since refuge establishment. Elk and moose have demonstrated similar patterns: initial records are of individuals, or complete absence for some periods, followed by a trend of slow growth over decades.

Prior to the 1950s, there were few moose in the Camas NWR region. With continued growth of the population, lower portions of the drainage continue to be colonized by moose, and populations apparently are increasing (Toweill 2008). Moose occur commonly on the Camas Creek floodplain, although they can be absent from the Refuge for extended periods. Moose may be transitory or resident, and are presumably attracted by locally scarce riparian and wetland habitats and sanctuary from hunting. Moose may be using Mud Lake WMA and Camas NWR as disjunct refugia in an otherwise hostile environment.

The elk population in this general area has increased dramatically from early historical records. Accounts of trappers in the mid-1800s suggest that elk were common, though buffalo and bighorn sheep were more numerous. Unregulated harvest of the late 1800s and early 1900s reduced populations to relatively low levels. By 1952, elk were believed to be numerous enough to warrant the first hunting season.

A majority of the area currently surrounding Camas NWR would not normally be considered elk habitat, as it consists largely of agricultural fields, farmsteads, and a few, scattered, small communities. However, elk use much of this agricultural zone, despite the unnatural forage base and lack of traditional escape cover. In fact, the exotic forage base, i.e., agricultural crops and especially alfalfa, are often an attractant to elk and apparently have increased elk use and occurrence in the area surrounding Camas NWR. Consequently, these adjacent farmlands, normally dismissed as unsuitable, must be regarded as a type of elk habitat. Security levels of adjacent areas are low due to lack of cover, and the five-month elk hunting season (August 1-December 31) in the local game management unit (GMU 63). Additionally, human activity is relatively high on much of the off-refuge area, particularly in the active farm fields. The relatively high levels of disturbance (noise and movement) probably reduce the attractiveness of the agricultural lands around the Refuge to elk, at least during daylight hours. These Camas Creek floodplain elk appear to be using the Refuge as sanctuary from disturbance, both lethal (hunting) and nonlethal (e.g., noise and movement of vehicles and farm machinery). As noted in Section 4.3.2 above, willow stands at Rays Lake stands are heavily used by elk, probably for escape and thermal cover, as well as forage.

Idaho’s mule deer population has fluctuated widely at least since the early 1800s, and likely previous to that time. Early accounts from that period indicated that deer were less numerous than buffalo, bighorn sheep, and elk. Deer declined through the early 1900s, probably due to unregulated harvest. By 1920 deer were quite rare. From 1920 to the early 1970s, deer numbers increased dramatically, interrupted briefly by significant winter mortality. Following a significant decline in numbers beginning in 1972, numbers again increased until the late 1980s. Mule deer populations increased more rapidly after refuge establishment than either elk or moose, culminating in much higher populations during the time period shown in this table. Ultimately, mule deer began to decline, although they still maintained a more robust herd size than either moose or elk through 1995.

Both on the Refuge and throughout Idaho, mule deer experienced high mortality in the winter of 1992-1993. Mule deer throughout the western United States began a decline at that time from which they are only now recovering and the refuge herd followed that west-wide trend. More conservative management has led to a fluctuating, but slightly upward trend regionally, with more-or-less stable mule deer numbers (Compton 2009), but the Camas NWR mule deer herd never recovered. Mule deer are now rarely seen on the Refuge.

White-tailed deer were absent from the Camas NWR area, or at least unobserved, until 1972 and then only sporadically recorded for approximately 10 more years. In the mid-1980s, reports of white-tailed deer began to increase rapidly and were beginning to surpass mule deer numbers by the mid-1990s.

Pronghorn were maintaining the largest herds of any of the ungulates at refuge establishment, and their numbers continued to be relatively stable for several decades. In the 1970s pronghorn began to decline on the Refuge, a trend which continued for the next 30 years. Unfortunately, refuge records are sketchy after 1976. Currently, pronghorn herds are the smallest of any refuge ungulate, excepting mule deer. There is currently a small herd of 20-50 pronghorn that can regularly be found within the Refuge. The herd splits and recombines into various groups, and also uses areas outside the Camas NWR boundary. When on-Refuge, the pronghorn can be found anywhere, but principally use the west and southwest quadrants where refuge alfalfa fields are located.

Table 4.18. Camas NWR Ungulate Populations

Year	Elk	Moose	Mule Deer	White-tailed Deer	Pronghorn	Comments
1941	1		2		60	
1942			1		88	
1943					150	
1944					150	
1945					175	
1946					100	
1947					150	
1948			3		150	
1949			1		300	
1950	1	1			150	1st Moose obs.
1951					350	
1952					350	
1953					65	
1954					135	
1955					155	
1956	1	1			220	
1957			31		195	
1958			8		140	
1959		1	15		195	
1960			14		185	
1961			25		150	
1962			19		25	

Table 4.18. Camas NWR Ungulate Populations

Year	Elk	Moose	Mule Deer	White-tailed Deer	Pronghorn	Comments
1963			40		116	
1964			65		98	
1965			46		125	
1966			65		150	
1967			65		160	
1968			59		155	
1969	3	1	116		138	
1970		3	140		170	
1971	1	3	65		150	
1972		4	75	1	100	1st WT Deer
1973						
1974			75		75	
1975			125		50	
1976						
1977						
1978						
1979						
1980						
1981			110	1		
1982						
1983	2		200	3		
1984	2	6	200	2		
1985	1	11	13			
1986		9	50	17		
1987		8	50			
1988		8	30	28		
1989	4	12	200	38		
1990		3	100	20		
1991	1	12	150	42		
1992	4	9	200	56		
1993						
1994	27	9	55	65		1st elk calves obs.
1995	20	9	55	65		

Source: Camas NWR files

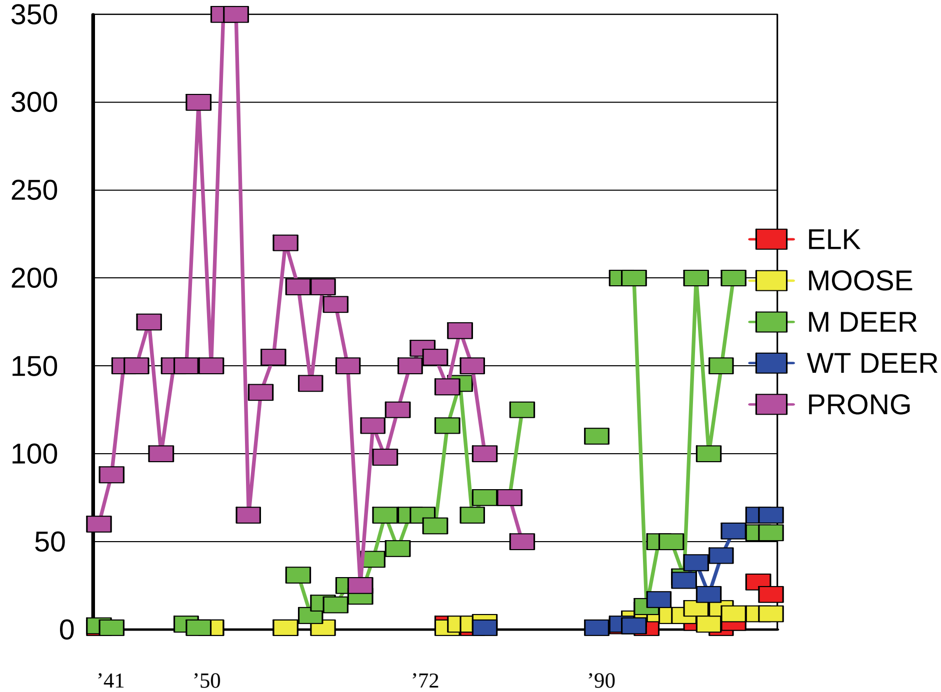

Figure 4.6. Camas NWR Ungulate Populations, 1941-2010.

Source: Camas NWR files

4.5 Threatened, Endangered, and Sensitive Species

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 species with Federal or State status, and other special status species, in the planning process.

At present there are no known Threatened or Endangered Species occurring on Camas NWR (Laye 2012). The Canada lynx is the only listed threatened species in the project area occurring in the eastern Snake River watershed; however, it occurs in high elevation habitat (subalpine forest) and therefore would be unlikely to occur on the refuge units (USFWS 2012a).

Candidate species include the yellow-billed cuckoo, and the greater sage-grouse (USFWS 2012b, c). In cooperation with the State Ecological Services office, every effort would be made to remain current on any changes in status (e.g., sage grouse listing), and necessary monitoring and management would be implemented.

The greater sage-grouse and northern leopard frog have a S2 State conservation status (imperiled; at high risk because of restricted range, few populations, rapidly declining numbers, or other factors that make it vulnerable to extirpation in the State of Idaho). The breeding populations of a number of bird species that breed at Camas NWR are included in the list of Idaho Species of Greatest Conservation Need. Species with S1 status breeding populations include: trumpeter swan, common loon, great egret, Forster's tern, and black tern, while species with S2 status breeding populations include: red-necked grebe, western grebe, Clark's grebe, snowy egret, cattle egret, black-crowned night-heron, white-faced ibis, Franklin's gull, California gull, and Caspian tern (IDFG 2005).

4.6 Exotic, Invasive, and Nuisance Species

One of the most striking features of the Refuge is the extent to which invasive plants and animals have taken hold. Invasive plant species displace native vegetation, altering the composition and structure of vegetation communities, affecting food webs, and modifying ecosystem processes resulting in considerable impacts to native wildlife (Olson 1999). The term invasive species refers to a subset of introduced or non-indigenous species that are rapidly expanding outside their native range. A species is regarded as invasive if it:

1. Has been introduced by human action to a location where it did not previously occur naturally;
2. Becomes capable of establishing a breeding population in the new location without further intervention by humans; and
3. Spreads widely throughout the new location.

Introduced species can become invasive for many reasons including:

1. the insects, fungi, mammals or other fauna that kept the species in check within its native landscape do not exist in the region to which the species was introduced.
2. the species is allelopathic (exudes chemicals which inhibit growth). Some species release chemicals which directly inhibit the growth of other plants, while others may release chemicals that negatively impact mycorrhizal fungi.
3. the invasive species has a competitive advantage such as earlier leaf-out, asexual reproduction, deeper root system, etc. (Wildflower Association of Michigan 2007).

Chemical, biological, or mechanical control of existing invasive species provides a competitive advantage for new growth of native species, which ultimately promotes healthy ecosystems through restoration of native plant communities. Early detection of new invasive species or new stands of existing invasive species greatly increases the efficacy of control measures (Bundy 2007).

4.6.1 Exotic and Invasive Species

Camas NWR hosts a variety of exotic (non-native) plants and animals, thanks in large measure its quasi-Mediterranean climate. Summers tend to emulate a Mediterranean model, while winters are of the very cold, continental type. Non-native species, especially plants, encountered in eastern Idaho typically are from the Mediterranean region and Eurasia. Consequently, except for the cold winters, the terminal region of Camas Creek provides very suitable sites for a host of non-native plant species. In many cases these species are well established and complete eradication is unlikely. The total plant taxa known to occur at Camas are 232 (combined 2008, 2009, and 2011 data). Of these, 150 are native to North America, 77 are non-native species, and five taxa are undetermined. This means that about half of plant species (51 percent) at Camas are introduced, non-native species (Miewald et al. 2012).

It is important to note that not all non-native species are considered invasive. For example, smooth brome was imported from Russia in the 1890s for forage and was widely planted. It has escaped cultivation and can be found in many natural areas in the western U.S. but in most situations, smooth brome would not be considered an *invasive species* because of its forage value for wildlife and livestock (National Invasive Species Council [NISC] 2006). The term “invasive species” is used here to denote:

> “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.” (NISC 2008)

Exotic Plants in Upland Habitats

As Euro-Americans settled the West, they brought with them species of animals and plants from different parts of the world. Some of these species arrived in North America by accident, while others were brought here intentionally. Some animals were brought here for agricultural purposes, some were brought to make the settlers feel more at home, and some, such as fishes, were released for the intention of sport. Plant species were also brought here intentionally for agricultural, landscaping, ornamental, and medicinal purposes (Mack et al. 2000).

The spread of invasive non-native plant species in upland habitats was facilitated by the rapid increase in land clearing and grazing that followed Euro-American settlement of the region. By the mid-1800s there were domestic livestock herds, including cattle and horses, both moving through and resident in the Upper Snake River Plain. Stock were being trailed across the eastern Snake River Plain in the 1860s, and by the late 1800s and early 1900s tens of thousands of domestic sheep wintered in the area. Livestock grazing is ecologically very different than grazing by bison, or other native ungulates. It is often a major factor in habitat change, because many native grasses and forbs are not adapted to heavy, prolonged, season-long grazing pressure and soil disturbance. Impacts of domestic herbivores were (and continue to be) pervasive and widespread. Historically, grazing utilization rates in this region have been much higher, and have persisted longer, than in natural systems. The introduction of domestic livestock therefore gave exotic grasses and forbs a competitive advantage over native species. In addition domestic livestock carry weed seeds from one site to another, increasing the rate of spread.

Other factors that historically influenced the introduction and spread of exotic weeds on Camas NWR, were the wagon roads and railroad lines. The old wagon road and stage coach line between Salt Lake City and Helena, Montana, ran through the Refuge. A seasonal “swing station,” where teams were changed out, was located at Sandhole Lake (see Chapter 5). This road was well travelled after gold was discovered near Bannack City in Montana in 1863. The numbers of draught animals using this trail was significant; one Army officer wrote that between September 2 and 26, 1863, he met with “over a hundred wagons” going down to Salt Lake City for supplies (Historical Society of Montana 1917). Stagecoaching commenced in 1863 and ended in the 1880s with the coming of the railroad; however, homesteaders continued to use the wagon road into the early 1900s.

In addition to freight wagons and stagecoaches coming through frequently during the active freighting season (April-November), the rest stop/way station at Sandhole Lake maintained various livestock on-site, including replacement horses and mules for the stage teams. The presence of the wagon road probably contributed to the development of farming in the area, since it created a ready market for grain and hay. By 1871 the small community of Hamer had been established. Resident herds of cattle and horses were kept on homesteads on and around the Refuge. For several decades, well into the 1930s, there were large winter feeding operations in the Hamer area for sheep that had spent the spring and summer in the upper Camas watershed. The presence of large livestock populations may have aided the introduction and spread of noxious, nonnative plants to the Camas Creek watershed.

The railroad touched only the eastern edge of the area now occupied by the Refuge, and continues to do so currently, but was more active in the late 1800s and early 1900s, than it is now. That nexus would certainly have been adequate to provide an avenue for weed introduction. The construction of Interstate Highway 15 created a much larger transportation corridor that further aided the spread of invasive plants.

Due to the favorable climate and numerous avenues of introduction, the exotic plant community at Camas Refuge is diverse and robust. Ironically, Camas Creek itself is a primary conduit for invasive species. It washes seeds into the Refuge from infestations that have taken hold in pastures upstream. Each summer when the creek bed dries, a miles-long ribbon of leafy spurge appears. Other species that line the creek banks are black henbane, musk thistle, Scotch thistle, and houndstongue (discovered in 2009).

The list of weeds found on the Refuge includes Canada thistle (*Cirsium arvense*), musk thistle (*Carduus nutans*), Scotch thistle (*Onopordum acanthium*), Russian knapweed (*Acroptilon repens*), leafy spurge (*Euphorbia esula*), black henbane (*Hyoscyamus niger*), cheatgrass (*Bromus tectorum*), and field bindweed (*Convolvulus arvensis*). In the 1940s, the main invasive plant species present on the Refuge were Russian knapweed, Canada thistle, sow thistle, and “morning glory” (field bindweed). The first mention of leafy spurge came in 1953. The 1956 Refuge Annual Narrative Report states: “The lowering water table has added to our weed acreage, sloughs that are now dry are heavily infested with several species.” Drying trends appear to be associated with increased prevalence of invasive species, and observation that still holds true today. The 1957 report declared that Canada thistle was the number one pest in the area. In 1960 white top was found on the Refuge as well. Musk thistle was first discovered on the Refuge in 1982. Leafy spurge was mentioned in the 1983 annual narrative, suggesting that it was becoming more of a problem. Dodder (an invader of alfalfa fields) was first mentioned in 1985. 1986 brought the first sighting of mullein on the Refuge. Swainson’s pea was discovered some time after 2000, and houndstongue was discovered in 2009.

Cheatgrass is considered an invasive species because of its capacity to cause environmental harm. Cheatgrass decreases the interval between the occurrences of wildfires in the Great Basin region from once every 70 to 100 years to every three to five years because it forms dense stands of fine fuel annually. The decrease in interval between wildfires causes increased risk to human life and property and also places at risk sage-steppe ecosystems and the wildlife that depend on them (Knapp 1996; Pimentel et al. 2000; USFWS 2003; Whisenant 1990).

Cheatgrass is currently not as dominant on the Refuge, or the Eastern Snake River Plain in general, as in other portions of the Snake River Plain further west. Cheatgrass nonetheless is well established and probably increasing, or certainly poised to do so. In fact, Germino et al. (2010) state that, “Cheatgrass abundance at Camas NWR appears considerably greater than at the INL [Idaho National Laboratory] and also USSES [U.S. Sheep Experiment Station] to the north.” These authors further indicated that the Refuge is in a precarious position with regard to invasive, exotic species: “ … there clearly are source populations of the exotics that should serve to provide propagule pressure that would likely lead to exotics on any disturbed areas in which substantive new plant establishment is likely.”

Russian knapweed exudes toxins from its tissues that inhibit the growth of surrounding plants or eliminates them. Desirable plant communities are placed at risk from Russian knapweed invasion, which may result in decreased numbers of wildlife species or livestock that the invaded land otherwise could support. Russian knapweed also is very toxic to horses (Stevens 1986; Young et al. 1970a, 1970b). Expansion of leafy spurge or other unpalatable invasive weeds displace desirable forage plants and may allow fewer grazing animals to survive in infested areas (DiTomaso 2001; Lym and Messersmith 1985; Lym and Kirby 1987).

The Refuge has begun to develop maps showing the distribution of weed species being treated with pesticides. This delineation is accomplished either by direct and focused mapping-only efforts, or while actually applying pesticides to the infestations. Currently it is estimated that at least 4,000 refuge acres are infested, but not all acres have been inventoried at this time. Map 13 below shows the distribution of major weed species on the Refuge as of 2009. While distributions are fairly accurate at present, this does not mean that new communities have not become established since this map was prepared. As an objective, approximately 500 acres of known infested habitat should be treated annually (as limited refuge resources allow) while preventing the expansion of existing stands and identifying new species should remain a high priority.

In the Refuge's recent vegetation inventory (Miewald et al. 2012), approximately 3,800 acres were classified as "ruderal," that is, dominated by non-native plant species to the extent that determining the original vegetation of the site is difficult. However, not all non-native species are considered noxious weeds, and some have value to wildlife. For example, exotic pasture and forage grasses have been intentionally introduced to the area, and in some areas have become dominant species. Today, most grasses on the Refuge are introduced "tame" pasture grasses, for example brome (*Bromus* spp.), wheatgrass (*Agropyron* spp.), perennial ryegrass (*Lolium perenne*), timothy (*Phleum* spp.), foxtails (*Alopecurus* spp.), bluegrasses (*Poa* spp.), orchardgrass (*Dactylis* spp.), and fescues (*Festuca* spp.). These grasses can, however, provide some benefits to some native wildlife. Short grazed or mowed pasture grasses are extensively browsed by Canada geese and are also used by foraging sandhill cranes and other waterbirds. Another introduced grass, which occupies significant acreages on the Refuge and forms some extensive monocultures, is crested wheatgrass (*Agropyron cristatum*). This species was introduced to the area in the 1930s and 1940s as a conservation tool to stabilize soil, reduce erosion and in some instances to provide early season forage for native, or domestic, ungulates. Phenologically characterized by very early spring growth, crested wheatgrass is usually green before native grasses have even started to produce and can be valuable to ungulates, especially pre-parturition females, in early spring.

Exotic Plants in Riparian and Wetland Systems

Of the previously listed invasive species at Camas NWR, few other than Canada thistle are management concerns in active modified wetland s and deeper, more permanent basins such as Sandhole Lake. These are basically weed-free, other than the surrounding edges, including dikes, if present. However, the situation is quite different in shallower, more ephemeral wetland habitats (wet meadows) and "inactive" wetland basins that can no longer be hydrated. As noted in section 4.3.1 above, more than 2,700 acres of the Refuge's 4,700 acres of historic wet meadow habitat has undergone type conversion to lowland non-native (ruderal) vegetation.

Introduced Birds

Exotic birds present at Camas NWR include European starlings (*Sturnus vulgaris*), house sparrows (*Passer domesticus*), Eurasian collared dove (*Streptopelia decaocto*), rock dove (*Columba livia*), gray partridge (*Perdix perdix*), ring-necked pheasants (*Phasianus colchicus*), and occasional feral waterfowl (*Anas* spp.). Pheasants and gray partridge are valued game birds.

Collared-doves are a relatively recent immigrant to Idaho, with the first sighting near Pocatello in 2003, but have been rapidly expanding since then. Their impact on native species is unknown. A recent study by Cornell University showed that native dove species were actually more common in areas where collared-doves were also present (Romagosa 2012). However the results of this study may not be applicable to this region.

Starlings and house sparrows can be considered invasive in that they compete with native cavity nesting birds, including mountain bluebirds (*Sialia currucoides*), tree swallows (*Tachycineta bicolor*), house wrens (*Troglodytes aedon*), kestrels (*Falco sparverius*) for rare nest sites. Feral waterfowl risk carrying disease from captive flocks into wild ecosystems. All of these species could conceivably compete with native species for insect and seed forage, and all provide prey for native predators—for instance, kestrels, merlins (*Falco columbarius*), peregrine falcons (*Falco peregrinus*), and prairie falcons (*Falco mexicanus*). Control of non-native birds has not been conducted on the Camas NWR.

Introduced Mammals

There are no known exotic mammals on Camas NWR, although the probability exists that exotic mammals do occur at least sporadically. Candidates include feral dogs (*Canis familiaris*), feral cats (*Felis catus*), and possibly house mice (*Mus musculus*). None are known to be permanently present to any significant extent, although if house mice do occur they likely do so in large numbers at selected sites. Dogs and cats are potentially serious predators of native wildlife, although cats and house mice, if they occur, also may provide food for native predators (coyote, great horned owls, and other medium-sized raptors).

Exotic Animals in Riparian and Wetland Systems

There are no known exotic or invasive invertebrates, amphibians, or reptiles known to be present on Camas NWR. Common carp (*Cyprinus carpio*) are not known in the Camas Creek drainage, which is a rare and unique situation in Idaho, and an exceptionally positive one from an ecological and management perspective. Neither are the exotic trout species, rainbow (*Oncorhynchus mykiss*) and brook trout (*Salvelinus fontinalis*), normally present at Camas NWR or other local wildlife areas, since Camas Creek does not provide adequate flow for salmonid survival during the majority of the season. Rainbow and brook trout could enter the Refuge from populations in the upper Camas Creek Basin during high spring flows, but would perish as soon as the creek dried (normally mid-July to early August).

4.6.2 Control Efforts

In accordance with Service policy 569 FW 1 (Integrated Pest Management), wildlife and plant pests on units of the Refuge System can be controlled to ensure balanced wildlife and fish populations in support of refuge-specific wildlife and habitat management objectives. An Integrated Pest

Management (IPM) approach is used, which includes a variety of tools: prevention of new introductions or the spread of established pests to areas not infested, mechanical or physical control methods, cultural methods, biological controls, pesticides, and habitat restoration/maintenance. The current draft IPM program for the Refuge is included as Appendix F. Control efforts are planned annually and Pesticide Use Proposals (PUPs) are submitted to regional and/or national IPM coordinators for approval. Chemical, biological, or mechanical control of existing invasive species provides a competitive advantage for new growth of native species, which ultimately promotes healthy ecosystems through restoration of native plant communities. Early detection of new invasive species or new stands of existing invasive species greatly increases the efficacy of control measures (Bundy 2007).

Noxious Weed Control

Control efforts began soon after the establishment of Camas NWR. In 1946 the use of the herbicide 2,4-D was first employed to treat weeds such as Russian knapweed, Canada thistle, sow thistle, and field bindweed (morning glory) (See History of Refuge Management). Refuge annual narrative reports document increasing numbers of exotic species, increased acreage and distribution of exotics, increased man-hours devoted to exotic plant control, and more use of chemicals and other control techniques over time.

The Refuge has used an Integrated Pest Management (IPM) approach to control noxious weeds since 1996. The Refuge's current IPM Plan is included in this CCP (Appendix F). Camas NWR has employed the use of mechanical, cultural, chemical, and biological control methods, including farming (crop rotation, summer fallowing), mowing, and in limited cases, the use of prescribed fire and the release of biological control agents.

An integral part of using an IPM approach to invasive species management is to also use an early detection/rapid response approach to control efforts. It is important that when new or small satellite infestations are found, that they be treated as soon as possible to prevent further spread. The first part of this approach is fieldwork to locate and map infestations of invasive plants. Camas NWR employs the use of volunteer labor to locate and map infestations using GPS and then records data into the Refuge Lands GIS system. Periodic mapping of infestations can also show whether the infestation is increasing or decreasing in size or time. This can help determine the effectiveness of our treatment procedures.

Biological Control

In 2009 and 2010, the Refuge also used biological control agents (insects) to treat infestations of Canada thistle. In 2009 there were four releases of stem mining weevils (*Ceutorhynchus litura*) and crown mining (seed head) weevils (*Rhinocyllus conicus*) on Camas NWR. In 2010 the 2009 releases were supplemented with fifteen releases of stem and crown mining weevils and fifteen releases of leaf defoliating beetles (*Cassida rubiginosa*). While biological controls may have resulted in reduced productivity of thistle, they have not resulted in significant reduction or control as of this writing.

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Chapter 5
Human Environment

USFWS

Chapter 5. Human Environment

5.1 Cultural Resources

This section presents a brief outline of the rich history and cultural heritage of Camas NWR. Archaeological and other cultural resources are important components of our nation's heritage. 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 (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 establish and 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.

Since cultural resources encompass many elements and time periods, the following simple temporal divisions were used to distinguish and categorize this brief review of the following resources.

- Native American Prehistory
- Pre-Contact Native American Traditions
- Post-Contact Traditions (Native American, British and United States)
- Recent U.S. Settlement and Economic Development Period
- Prehistoric and Historic Sites on the Refuge

5.1.1 Native American Prehistory

The southeastern Idaho region has a long history of human habitation that archaeologists often divide into specific periods based on the archaeological record, tool forms and types, and resources that were exploited. The region's artesian springs and pot-hole lakes attracted large mammals and waterfowl, and also drew the attention of early hunters and gatherers. The archaeological evidence indicates 15,000 years or more of human occupation on the Snake River Plain and within the Pioneer Basin, of which the Refuge is a part (Butler 1968, 1978; Swanson et al. 1964). The following discussion is drawn largely from Harding 2005.

Archaeological evidence of the region's early big game hunters, known as Clovis people after their characteristic spear points, dates between about 12,000 to 11,000 years before present (B.P.) and is generally limited to isolated finds and deposits of cultural materials, and various caves such as Wilson Butte Cave, Jaguar Cave, and Kelvin's Cave (Harding 2005:10). The Clovis people followed big game animals such as mammoth, horse, and camel. The transition to a smaller style of projectile point, known as the Folsom fluted projectile point, dates to between 10,000 and 9,000 years B.P. and indicates a shift to hunting archaic bison (*Bison antiquus*). Between 9,000 and 7,500 years B.P. there was a further transition to a lanceolate projectile point form. Sites associated with this transition period include remains of both archaic and modern bison (*Bison bison*), as well as mountain sheep (Harding 2005:10).

The Middle Prehistoric period dates from approximately 7,500 to 1,300 years B.P. People living during this time period appear to have used a broader array of resources that included bison, smaller game animals, and plants. Archaeologists theorize that a continuous population base in this region developed up to 8,000 years B.P. and continued to develop through the Middle Prehistoric period (Holmer 1994; Swanson 1972), and into the Late Prehistoric period (1,200 years B.P. to about 150 years B.P.) (Harding 2005:12; Ringe et al. 1988). There also appears to be a heavy reliance on large animals because there is little evidence of plant processing tools (Harding 2005:12). New technologies such as the horse and European trade goods began to be introduced into the area as early as 300 years B.P and continue into the Northwest Fur Trade era. The prehistoric period shifts into the ethnographic period as the trade goods and Euroamericans entered Southeastern Idaho.

5.1.2 Pre-contact Native American History

The descendants of those prehistoric people are the Shoshone and Bannock people who lived in the vast geographic area within the Great Basin, the Plateau and into the Great Plains. The Shoshone and Bannock peoples lived in groups composed of highly mobile nuclear families or family clusters, egalitarian in nature, which practiced wide-spectrum subsistence activities. The general subsistence pattern consisted of seasonal rounds to areas where particular resources were abundant. Spring and summer were characterized by hunting, fishing, and gathering, while autumn was characterized by a move to the mountains to gather pinyon and other pine nuts, and in some areas, acorns. Winter was spent at low elevation camps along drainages. Foodstuffs were preserved by drying if they consisted of fish or meat, or by roasting if they consisted of nuts, then cached for use during the winter. Fish were primarily exploited in the spring, when the stores of bison meat were running low. After acquisition of the horse, resources were more efficiently exploited, and loosely cohesive bands were formed (Steward 1955).

During the historic period, the Shoshone and Bannock speaking people lived and traveled in the southeast Idaho area. They included bands living in the high mountainous areas of Central Idaho, the Yellowstone Sheepeater bands to the east of the Camas NWR, the Eastern Shoshone in Wyoming, and the Fort Hall bands. Other tribes referred to the Shoshones and Bannocks as “Snake Indians.” Non-Indian fur traders picked up this name, and used it to refer to both the Shoshone and Bannock peoples. They are two distinct tribes, with different languages, but have lived with each other, with similar lifestyles and in the same general geographic locations sharing common resources (Albers 1998).

The Shoshone and Bannocks established winter village sites primarily around rivers and streams, but a particular favorite village area was at the Fort Hall bottoms of the Snake River, to the south and west of the Refuge area, which provided prime lands for wintering and forage for their horse herds. Social and economic relationships occurred between bands and other tribes, through trading, intermarriage and maintenance of extended families ties, religious and ceremonial activities. The Shoshone and Bannocks were the most frequent users of the lands within the Camas NWR as a travel corridor, utilizing the various subsistence resources along the way. Nez Perce bands passed through the area on the way from their traditional home in central and northern Idaho to the plains of central Montana to hunt buffalo. Raiding parties of the Crow and Blackfeet tribes occasionally used the area as a route when attacking the Bannocks to the south and the Lemhi Shoshone who made their home in the mountain ranges of central Idaho and southeast into Montana. The Flatheads of northwest Montana and north Idaho were also occasional visitors as both raiders and traders (Richardson n.d.).

5.1.3 Post-contact Native American History

The nineteenth century brought huge transformations in the subsistence cycle and lifestyle traditions of the Shoshone and Bannock people. The Lewis and Clark Expedition crossed through Idaho about 100 miles north of the Camas NWR. Their reports of abundant fur bearing animals set the stage for an influx of fur trappers. The fur trade period reached its height in the late 1820s. By the 1840s aggressive trapping had nearly extinguished the beaver and other fur bearing animals. Big game populations in Idaho, but especially bison, declined during the fur trade era as well. After bison grew scarce in the Snake River Plains in the late 1830s, the Shoshone and Bannock people travelled the “Bannock Trail” to access bison hunting grounds in Montana and Wyoming (Haines 1964). The trail began at Camas Meadows in Idaho, crossed the Henry’s Fork and then over Targhee Pass to the Madison River in Montana, bisected the southern end of the Gallatin Range into the Gardner River drainage, and then proceeded eastward up the Yellowstone and Lamar Rivers in present-day Yellowstone National Park. The route then split into a number of connecting trails leading to buffalo hunting areas in the Madison, Gallatin, Yellowstone, Clark Fork, and Shoshone River valleys (Haines 1964). Since the present day Refuge lay along travel routes to both the camas meadows near present-day Kilgore, Idaho and the Bannock Trail, and had permanent water in an otherwise arid region, the area would have been an attractive campsite.

The ever-increasing encroachment into the aboriginal lands of the Shoshone and Bannock resulted in reduced subsistence resources, which led to increased Indian resistance. By 1840 bison were rare in Idaho, and were extirpated by 1860. During the 1840s to 1870s, the Oregon Trail emigrants, miners, and railroad construction crews increased the competition for natural resources that the Shoshone and Bannock had relied on for hundreds of years. Not only were large game animals hunted out, but the emigrants’ herds of cattle and horses, and later herds of livestock being trailed between Oregon and Wyoming, denuded plants that were important foods as well (Harding 2005: 16).

The loss of resources and sudden increase of non-Indian people moving into traditional hunting and gathering areas led to the Nez Perce War of 1877, the Bannock War of 1878, and the Sheepeater War of 1879 (Harding 2005:16).

In an effort to control and limit the Shoshone and Bannocks’ use of traditional lands, and to provide lands for use by non-Indian settlers and ranchers, President Andrew Johnson signed an Executive Order establishing the Fort Hall Indian Reservation on June 14, 1867 (Madsen 1980: 51). The following year (1868), the Fort Bridger Treaty was signed between the United States government and the Eastern Shoshoni and Bannock Indians. Provisions of that treaty include the right to continue to hunt on the “unoccupied lands of the United States.” Immediately after the signing of the Treaty, Shoshoni and Bannock bands were moved to the new Reservation. The Office of Indian Affairs was to provide food, clothing and equipment for those Indian Reservation residents. But with the failure of the Indian Agents to provide rations, the Indians had no choice but to continue to conduct hunting and fishing excursions off reservation.

Meanwhile, up north in Salmon River country, the Virginia City Treaty of 1868 was signed at Virginia City, Montana Territory, for the mixed bands of Shoshones, Bannocks, and Sheepeaters (Mann 2004: 28). This treaty was not ratified by Congress. Instead, in 1875, President Grant signed the Executive Order establishing the Lemhi Valley Indian Reservation, which contained 100 square miles, along the Salmon River. This Reserve was in existence from 1875 to 1907, but the United States relentlessly attempted to remove residents from the Lemhi Reservation. During this time and until 1907, the Lemhi Reservation residents put up fierce resistance. Upon the death of Chief Tendoy, and facing deteriorating conditions at the Reservation, the Lemhis were finally forced to move to the Fort Hall Reservation. This opened the Lemhi Shoshone's reservation lands to non-Indian Salmon area residents.

Survivors of the forced removal relate stories of two routes. One route identified in history books is called "the Lemhi Trail of Tears" by the Lemhi descendants. (Mann 2004:35). They traveled northeast from the Salmon River over the Lemhi Pass into Montana, then south through the Snake River plain eventually arriving at the Fort Hall Reservation. Once they arrived at the Montana railroad, they were loaded into box cars and shipped to Fort Hall. As related by oral history by the Lemhi survivors, many people were reluctant to travel on train cars because "only prisoners of war were transported by rail," and they escaped back to the Reservation on the Salmon River. The second removal occurred after the numerous Lemhis returned back to the Lemhi Reservation along with the escapees. This second removal came through a different route, as the remaining Lemhi Indians were forcibly removed, with their homes knocked down, and marched south through the Lemhi/Birch Creek valley through the desert to Fort Hall (Ariwite 2013).

Today, the Shoshone-Bannock Tribes is a federally recognized tribe, and is headquartered on the Fort Hall Reservation, located adjacent to the communities of Pocatello and Blackfoot, Idaho. There are approximately 6,000 Tribal members who value their rich history, cultural practices, and their rights reserved by the Fort Bridger Treaty.

5.1.4 Recent U.S. Settlement and Economic Development Period

Following on the heels of the fur trappers were settlers who used established travel routes across the plains and through the Rocky Mountains. The westward migration of settlers through traditional Shoshone and Bannock territory increased throughout the 1840s and 1850s, primarily using the Oregon Trail. Adding to the traveling populace was the Mormon migration beginning in 1847. Many of the towns in southeastern Idaho were established by Mormon emigrants during the 1860s and 1870s (Harding 2005).

The Montana Trail (also called the Corrine-Virginia City Trail or the Salt Lake City-Bannock Trail) was blazed in 1863 to connect Salt Lake City to the newly discovered Montana gold fields, following the general path of today's Highway 15 that passes to the east of Camas NWR. It was the first important overland route to the goldfields in Montana. It followed the old fur trade routes, and connected the Utah settlements along the Oregon Trail with the mining communities to the north in western Montana (Ingram 1976; Montana Fish and Game Commission 1975). The Montana Trail led northward through Utah and Idaho (passing by the present-day Refuge), and crossed the Continental Divide into Montana over Monida Pass. The Trail split along the Beaverhead River: one fork went to Bannack and the Deerlodge Valley to the north, while the main fork led to Virginia City and on to Helena, connecting with the Mullan Road. Completion of the Union Pacific Railroad through Wyoming into northern Utah in the 1870s increased the dominance of this trail (Montana Department of Fish, Wildlife and Parks 2001).

This road was heavily used by both freight wagons bringing supplies from Salt Lake City to the mining towns of Bannack and Virginia City, and by stagecoaches that carried passengers and "fast freight": mail, medicines, and gold. In fact one Army officer wrote that between September 2 and 26, 1863, he met with "over a hundred wagons" on this road, enroute to Salt Lake City for supplies (Historical Society of Montana 1917). By 1864, a seasonal "swing station" where teams of horses or mules were changed out, had been constructed on the present-day Refuge at Sandhole Lake. The station was called Sandhole, Sand Wells, or Desert Wells in various accounts and stagecoach timetables. Swing stations were small stations where teams were changed, located approximately 12 miles apart, as opposed to the larger "home stations" 40-50 miles apart, where they would change drivers as well as horses. Home stations had more amenities for travelers. Sand Hole station was a humble affair, as this account attests:

> "May 1864—Montana was made a territory and in July the Government established a regular mail service, with stage transportation, between Bannack and Salt Lake City … the trip took 92 hours (4 days and 4 nights) … at Sand Hole, the meal served at a log cabin for one dollar consisted of sagebrush tea, strong butter, heavy, sour bread, and greasy pork" (Judson 1909).

In a 1984 interview, longtime resident Elvin Henninger, who was born in 1882, recalled: "Camas Station [was] just a little ways on [from Sand Hole] … on this bend of Camas Creek. That was an all year station. That was built in 1864 when the holiday [Ben Holliday] took over the mail route. [General] Howard camped there the 19th of August [1877] and they described great stacks of hay on the ground [that] went through that battle [Battle of Camas Meadows] undisturbed too. Evidently the stage stations had gone in, the contractors and stacked hay for the stage stations" (Henninger 1984).

The first stagecoach service from Salt Lake to Virginia City, Montana was by the Oliver and Conover Stage Company, which established a line in 1863. However, Ben Holliday's Overland Stage Company proved too competitive and forced them out of business in 1864. The Overland Stage from Salt Lake to Virginia City, Montana ran triweekly and took 4 days (Idaho State Historical Society 1970). In 1867, Wells Fargo purchased Ben Holliday's Overland routes, including the Salt Lake to Helena, Montana route. In 1869, Wells Fargo sold its Ogden to Helena Line to Gilmer and Salisbury Company. Gilmer and Salisbury continued the service until the opening of the Utah and Northern railway in 1881 (Saunders 1915). However homesteaders continued to use this and other local wagon roads into the early 1900s.

We know the names of two early station keepers at Sandhole. One was Maier Kaufman, a German immigrant who came to the United States in 1845 at age 15. In 1860 he became an express messenger for Ben Holliday's Overland Stage Company. According to a biography, he left that company for the Fargo Express Company's Corinne to Helena line, and "he was later employed by the Gilmore & Saullsbury [sic] Stage Company." Following his marriage in 1862, "he kept stage stations for the firm of Gilmore & Saullsbury at Millerville, Wyoming, at Kaysville, Utah, at Centerville, Utah, at Sand Hole, Idaho, and Hole in the Rock, four miles above the present site of Dubois, Idaho, where he was stationed during the Nez Perce war." A year later (1878), he left Hole in the Rock Station to become a farmer (Hawley 1920).

Another station keeper was Charles Johnson Hitchcock, a Mormon emigrant from England who arrived in the U.S. with his wife Rosina Kathleen Jemmett and his recently widowed mother-in-law, Mary Ann Browning Jemmett, in 1865. Shortly after their arrival in New York, they travelled across the plains with the Miner Grant Atwood Company to Utah. A family genealogist writes that "Rosina [Kathleen Browning] married Charles Johnson who operated the *Sand Hole Stage* Station in Kamas Idaho" (deVore n.d.).

In 1874, “Sand Hole” was still a “little swing station” on Gilmer and Salisbury’s line from Corrine, Utah to Fort Benton, Montana. Sand Hole was in between McCammon, Idaho and Pleasant Valley, which under good conditions was a day’s travel. Alexander Toponce recalled that, when they stopped at noon at Sand Hole, after starting from McCammon in the morning (they were running late), “the station keeper was really a nurse for the stage mules and not an experienced cook” who could be expected to feed the travelers (Toponce 2006).

In addition to the bustling activity of the freight wagons and stagecoaches coming through frequently during the active freighting season (April-November), the Sandhole station maintained various livestock on site, including replacement horses and mules for the stage teams. The presence of the wagon road probably contributed to the early development of farming in the area, since there was a ready market for grain and hay to feed the animals. Travelers noted that the small village of Hamer was in existence by 1871, and the farmers there were dependent on artesian wells to irrigate their crops.

The road by Sand Hole was not only used by wagons and stagecoaches, but also by ranchers and sheepherders trailing their stock. Livestock production was a commercial industry along the Snake River Plain by the late 1860s, but it remained transient as cattle and sheep were trailed between the coastal states and grasslands east of the Rockies. In the early 1880s, many sheep were trailed to Wyoming from the west (Oregon), passing through Idaho enroute (Wentworth 1948). One sheepherder noted that “July 25th — Left band in morning and came on to Eagle Rock. From Mud Lake there are two trails; one leaving lake and going direct to Market Lake; the other following creek and going to Sand Holes. First is best and shortest trail, but the other not so far without water. Distance between two lakes by shortest trail good 20 miles” (Evans 1951). Today, archaeological remains of historic livestock drives and early grazing are embodied in numerous roads and trails that cross the Snake River Plain (Anderson 1999).

The Utah and Northern Railroad (UNRR) paralleled the wagon road, eventually replacing stage stops with depots (Derig 1996:13). The UNRR was constructed as far as Franklin, Idaho with assistance from the LDS Church in the early 1870s. The Utah and Northern from Corinne, Utah, followed the old Corinne (Montana) Trail and reached Butte, Montana, in 1881, marking the effective end of stagecoaching along this route (Montana Department of Fish, Wildlife and Parks. 2001). In 1882, the UNRR was merged with the Union Pacific (Harding 2005:16). The UP track extends along the eastern boundary of the Refuge. However, the old wagon road north to Montana continued to be used by emigrants, lastly by an influx of Mormon emigrants enroute to new communities in Canada in the late 1800s/early 1900s.

The General Land Office (GLO) surveyed the townships and ranges that comprise the current Camas NWR in 1882, 1884 and 1891. Their maps and notes identify roads, individual houses, and the railroad, but little agricultural development (Bureau of Land Management, GLO Records, Survey Maps). A small field with ditches, and further south a small stock pond, were noted on Camas Creek. A “house” (probably the stage station) was surveyed in 1884 between the “Montana Road” and a “slough.” Today the site is known as Sandhole Lake. The house was a stage station, and a woman visiting the Refuge in 1957 recalled living at the stage station near Sandhole Lake when she was a small child. She was able to identify several stone foundations as the ruin of the inn where she was born. She also was searching for graves of two brothers (Camas Migratory Waterfowl Refuge 1957:3). Unfortunately, her name was not recorded. A later stage station, ca. 1890s, was located at the refuge headquarters and had a substantial blacksmith shop. An 1882 survey also shows a “Lawson’s House” on Camas Creek (Bureau of Land Management, GLO Records, Survey Maps).

Real incentive to settle the eastern Snake River Plain came with the Homestead Act of 1862, the Desert Claim Act of 1877 (19 Stat. 377) which amended the Homestead Act, and the Carey Act of 1894 (28 Stat. 422). In this era Idaho obtained one million acres of federal land for homesteading. The Camas area was surveyed in 1884 (east half) and 1899 (west half) (Bureau of Land Management, GLO Records). After the area was platted, parcels were acquired by settlers. The Desert Claim Act offered up to 640 acres (2.6 km^2) of land to an adult married couple, or 320 acres (1.3 km^2) to an individual, who would pay $1.25 an acre and promise to irrigate the land within three years. In the 1890s homesteaders began quickly claiming land within the Camas NWR boundary area. In some areas, family members patented adjacent lands in order to encompass extensive acreage for livestock grazing, agricultural crops, and water resources. In all, sixty-one land claim patents were filed on the present-day Camas NWR between 1890 and Refuge establishment. More than half were homesteads filed under the 1862 Homestead Act requirements; eighteen claims were cash entries whereby the settlers purchased the land; four were filed under the terms of the 1877 Desert Claim Act; three were filed under the Stock-raising Homestead Act; and two were Forest exchanged lands.

The first land patent on the Refuge was for 319 acres by Humphrey Toomey (for which Toomey Pond was named) in August 1889, under the Desert Land Act. He was soon followed by Omer T., Milo, and Ambrose Adams in March of 1890. They each claimed approximately 160 acres under the Homestead Act. In June 1890, Elias Ray homesteaded the E½W½ of T7N R36E Sec 30. The parcel containing the refuge headquarters was homesteaded by James H. Adams in 1892. In 1901 Louis Lienemann acquired 424 acres in sections 13, 18, 19, and 24 under the Desert Land Act of 1877. The NE¼ of Sec 30 purchased by Claude Hixson in 1904. George and William Bird acquired the SE¼ of section 30, which contains a portion of Rays Lake, in 1912 and 1914, respectively. Sarah Richardson purchased in E¾S¼ T7N R36E Section 18 in 1915 under the Homestead Act (Bureau of Land Management, GLO Records).

When these homesteaders first arrived on the present day Refuge they found a predominantly dry landscape, except for a slough (Sand Hole) next to the stage station, which was fed by artesian flow. “Sand Hole” apparently varied in size; an 1882 survey map shows three “Sand Hole Ponds,” while the 1884 survey shows a “slough” at the site. The site of present day Ray’s Lake was a “Dry Lake,” hinting at wetter conditions in the not too distant past. Survey notes described willows here, indicating a water table close to the surface where wells could be dug. Likewise, in the late 1800s, Mud Lake was a shallow, intermittent body of water (Stearns et al. 1939). In 1900 herds of cattle being driven to Arco had to be divided in half to provide access to all (Gerard 1963).

The Desert Land Act of 1894 (generally known as the Carey Act) and subsequent amendments encouraged the states, private investors, and the Federal government—the latter through the General Land Office (GLO)—to provide cooperatively the water-supply facilities necessary to make farming communities of previously arid habitat (Original act, August 18, 1894, Chapter 301, Section 4, 28 Stat. 422 entitled “An act making appropriations of sundry civil expenses of the government for the fiscal year ending June 30, 1894, and other purposes”). During the first several decades of the twentieth century, several western states, and in particular Idaho and Wyoming, successfully used the Carey Act to create thousands of family farms. Across the West, more than one million acres were patented. More than half of that acreage was in Idaho alone (Lovin 1987). Mud Lake land was opened to settlers through the Carey Act. The Mud Lake area was developed by irrigating from Camas Creek, by pumping from Mud Lake, and by pumping from wells.

In 1902, Idaho received funding through the Reclamation Act to build canals to “reclaim arid lands” (Reed et al. 1987). During the next three decades, hundreds of miles of irrigation canals were dug in the region. However, of these projects, only part of the Mud Lake project was successful (Anderson 1999). In 1908 the first water filing was made on Mud Lake for irrigation and in 1921 more than 150,000 acres was included in several projects for which it was planned to obtain water from Mud Lake and nearby lakes and sloughs. This acreage was divided among two large Carey Act projects aggregating about 30,000 acres, and numerous private irrigation enterprises. By 1929, 300 wells were in production (Jorgensen 1979).

The hydrology of the Camas/Mud Lake area began to change in the early 1900s, due to subirrigation on the Egin Bench, 15 miles to the east. This subirrigation, intended to raise the local water table, created a huge body of subsurface water (estimated at 326,000 acre-feet), some of which leaked to the north and then to the west, ultimately arriving in the Mud Lake Basin (see Chapter 4). Some of the water leaking from Egin Bench flowed down Camas Creek into Mud Lake, while some of the water moved through a shallow aquifer, and emerged as artesian springs or wells. Subirrigation started in 1985, and by 1900 standing pools of water were noted near Hamer. From 1908 to 1914 Mud Lake rose about 5 feet. Staley and Hartwell (1982) noted between about 1914 and 1920, many local farmers had left the Mud Lake/Camas area, as the rising water table caused their dikes to fail.

In the 1920s Mud Lake farmers constructed dikes to halt flooding of their land, ultimately creating an impoundment that allowed Mud Lake to rise 8 feet (Idaho Office of Attorney General 1988). While this allowed farming to thrive in the Mud Lake area, it did not help the Camas farmers. If storage increased enough, water would flow up Camas Creek, where it would be redirected into what had been “Dry Lake” (present-day Rays Lake). This appears to have happened in June 1921 when storage reached 55,000 acre-feet (Stearns et al. 1939), and again in 1922, 1923, 1924, and 1926 (USGS data).

By 1921, a substantial area of the present-day Refuge had become too wet to farm. Sandhole Lake and Rays Lake were more or less their present size, and lower swales had become marshy. The change from dry to wet appears to have happened rapidly. For example, Sarah Richardson acquired her property in 1915. Six years later, the area was a wetland, as shown on a map prepared in 1921 (Stearns and Bryan 1925).

While the area that eventually became Camas NWR was mostly too wet for crops, it continued to provide pasturage and hay fields for livestock. Indeed, seasonally wet areas (wet meadows) provided excellent “wild hay.” Stearns et al. (1939) noted that “During recent years the cattle industry of the Mud Lake region has been largely replaced by the sheep industry until now about a quarter of a million sheep are raised here annually.” The U.S. Sheep Experiment Station (which is still operating today) was established six miles north of Dubois in 1915. Here, efforts were made to breed sheep that produced both mutton and high quality wool. The Woods Livestock Company, founded by J.D. Woods in 1890, with headquarters at Spencer, and the Wool Growers Association of Sugar City controlled most of the range in the Camas NWR area. Hugh C. Woods, son of J.D. Woods, filed a patent on refuge lands in 1912 (Bureau of Land Management, GLO Records). H.C. Woods was known for pioneering such concepts as range reseeding, supplemental feeding at winter ranges, and the “blanket” system of herding which was novel then, but later became commonplace (Roberts 1961). By the 1910s the ranch had grown and developed into a large stock raising operation. The ranch house and outbuildings were torn down when the refuge headquarters was built at the same location. The ranch’s blacksmith shop survived for many years after the Refuge was established but is no longer standing.

In the winter, sheep were fed at the irrigated tracts at Egin Bench, Roberts, and Mud Lake. Both alfalfa and wild hay (supplemented with protein concentrate) were fed. A large winter feeding operation existed at Hamer in the 1930s (USDA 1933). In the spring they were grazed on the lava plains at the foot of the Centennial Mountains. Later as the grass dried and water became scarce, the sheep were driven into the mountains for the summer. In the fall they returned over the same route using the spring range on the way to the feeding grounds (Stearns et al. 1939). The Woods Livestock Company liquidated in 1934; however, a grandson of J.D. Woods, Dave Hagenbarth, established his own outfit using some of the same range and brands formerly used by the Woods Livestock Company (Roberts 1961). By the time the Refuge was established much of its lands were owned by Idaho Livestock Lands Inc. (FWS Realty files). A 1936 map showed that both "wild hay" and about 1,000 acres of "tame hay" were harvested on much of the refuge lands. The tame hay was "of good quality due to past drilling in redtop clover and timothy or broadcast seeding." Some of the area was being grazed; managers noted that there was "well sodded grass adjacent to marshes [that] would produce hay if protected from grazing." A relatively small acreage was planted in grain (perhaps 140 acres total), near the present-day headquarters, on the east boundary of the Refuge, and along the northeast margin of Rays Lake.

Development of Camas National Wildlife Refuge

The Great Depression played a role in the development of the Camas NWR. In the winter of 1937-1938, shortly after Camas NWR was established by Executive Order, the first of a series of Works Projects Administration (WPA) crews began working on the Refuge. The WPA program at the Refuge included between 24 and 50 men over the four years the program was active on the Refuge. The first projects were to clean up and fence the Refuge and improve a road to the headquarters site. Since the site chosen for the headquarters was the location of a previous ranch, most of the ranch buildings were torn down and the site prepared for the new buildings. At the same time, designs and plans for the new refuge headquarters were prepared by staff in the Washington D.C. office (see below). Most of the headquarters construction occurred between 1938 and 1939. The following is an account from the Camas Annual Report of 1939 (Camas Migratory Bird Refuge 1939):

> The Headquarters residence was 95% complete at end of June, 1939. Materials from NIR (National Industrial Recovery Act) funds, salvage from Camas Refuge and from Fort Peck, Montana. Service Building (Type 10 without basement) was 85% complete at the end of June 1939 … All labor WPA except services of plumber and plasterer. Three sheds and one frame house were razed to provide building materials. 10 loads of old iron and machinery were broken up and hauled either to dump if not usable or to site of building operations for use as reinforcing.

5.1.5 Prehistoric and Historic Sites on the Refuge

Archaeological evidence of Native American use on Camas NWR is limited to five sites and an isolated projectile point. Two of the sites (10JF144 and 145) are only referenced by their location, but there is no documentation available. Two sites (10JF146 and 147) are small lithic scatters that are probably ineligible to the NRHP (see Table 5.1 below). One site (10JF394) contains rock circles that may be the remnants of tipi rings and was recommended to be eligible to the NRHP (Harding 2005). The isolated projectile point is an Elko corner-notched type that was used for a rather long period over a wide area of the Great Basin and Plateau regions. Isolated artifacts are ineligible to the NRHP. There has never been a large scale village or Paleoindian site identified within the refuge boundaries.

The presence of such a small number of sites relating to Native American people on the Refuge is probably due to the fact that less than half of the Refuge has been surveyed for archaeological evidence and because of the marshy condition of the refuge core area. Use of the area by Shoshone and Bannock people is expected. The occasional projectile point or tool may be found, but no Native American camps have been identified on the Refuge. Recorded prehistoric sites are summarized in Table 5.1.

None of the archaeological sites recorded on Camas NWR are documented as containing human remains. However, if sites identified on the Refuge are found to contain human remains, funerary items, sacred objects, or items of cultural patrimony, then consideration under the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) will be required.

Table 5.1. Recorded Prehistoric Resources on Camas Refuge

Site #	Site Type	Description/ Materials	Condition/ Integrity	Eligibility[1]- A, B, C, D	DOE[2]	Surveyor/ Report Author. Date Recorded
10JF144	Prehistoric	No site form.				
10JF145	Prehistoric	No site form.				
10JF146	Lithic scatter	100-200 flakes, mostly ignimbrite, no tools.	Poor	NE		D. Corbett, BLM, 1980
10JF147	Small lithic scatter	100-500 flakes, mostly ignimbrite, no tools.	Poor	NE		D. Corbett, BLM, 2005
10JF393	Isolate	Obsidian, Elko Corner-notched point.	N/A	NE	N/A	W. Harding, 2005
10JF394	Rock rings	Protohistoric, flakes and glass, tipi rings (?).	Fair	D		W. Harding, 2005

[1]Criteria A, B, C, D based on NRHP.
[2]Determination of Eligibility with SHPO concurrence, need date and verification.

Big Southern Butte and its associated sacred landscape are very important to the Tribes. Big Southern Butte is the largest and youngest (300,000 years old) of three rhyolitic domes formed over a million years near the center of the Eastern Snake River Plain in Idaho. It consists of two coalesced lava domes with a base diameter of 6.5 kilometers (4.0 miles). In essence, the Big Southern Butte sacred landscape consists of the area that can be observed from the top of Big Southern Butte, which rises approximately 2,500 vertical feet (762 meters) above the lava plain. The butte has not been formally evaluated as a traditional cultural property, but the butte is visible from the Refuge; major changes to the landscape should be considered in terms of this viewshed.

Historic Period Sites. A number of known historical sites were tied to agricultural land claims. Sixty-one land claim patents were filed on the Camas NWR. There were 53 individuals who may have built homes, buildings, and fences on lands now encompassed by Camas NWR. The potential for finding archaeological evidence of nineteenth-century settlers is therefore very high. For instance, all seven historical archaeological sites identified to date are related to homestead settlement.

The Camas NWR headquarters is composed of three primary buildings built by the WPA: the service building, which includes the office and four-bay vehicle storage and shop; the equipment shed; and the refuge manager’s residence. Plans for the service building and equipment shed were developed during the early 1930s by architects in Washington D.C for the Bureau of Biological Survey. They were originally designed for Hart Mountain Antelope Refuge in Oregon, but were slightly modified to fit the needs of Camas NWR. The residence was a new design, developed in the Washington D.C. office for the Refuge in 1938. Secondary buildings, such as the oil house, have been added to the headquarters. The oil house was constructed in the 1950s and built with CMU block; this building was determined to be ineligible to the NRHP (see Table 5.2 below). A new shop was added to the headquarters compound in 2005-2006 and a residence was constructed off-site for the refuge manager in 2001.

A portion of the existing dikes, canals, bridges, culverts, and other infrastructure were built by the WPA workers between 1938 and 1941. There are currently 26 miles of dikes, 34 miles of canals, 9 irrigation wells, 9 bridges, and 130 water control/irrigation structures (Camas NWR Real Property Inventory). One bridge (51-017946) has been recorded that was part of the 1930s development of the Refuge (Harding 2005).

Another site that may have historical significance is the site of the old Stage Coach Inn near the shore of Sandhole Lake. The inn was occupied during the height of traffic that traveled to and from the gold mines in Montana. Building foundations and wagon wheel tracks are still visible at the site.

Table 5.2 lists the historic-period resources on Camas NWR that have been recorded to date.

Table 5.2. Recorded Historic Period Resources on Camas Refuge.

Site/Resource Patent #	Site Type	Description	Integrity	Eligibility[1] A,B,C,D	DOE[2]	Surveyor/ Report Author, Date Recorded
10JF389 320613	HE, James Henrie 1913	Glass, ceramic, cans, stove, horseshoes, barrel hoops.	Poor	NE		Harding 2005
10JF390 356051	HE, Thomas Gange, 1913	Depression, ceramics, glass, cans, nails, etc.	Poor	NE		Harding 2005
10JF391 655395	HE, James Collins 1918	Foundation, depression, ceramics, glass, cans, etc.	Poor	NE		Harding 2005
10JF392 450917	HE, William Dalton 1914	Bottles and cans dump. Purex.	Poor	NE		Harding 2005

Site/Resource Patent #	Site Type	Description	Integrity	Eligibility[1] A,B,C,D	DOE[2]	Surveyor/ Report Author, Date Recorded
10JF396 1050	CE, Charles Schmidt, 1901	Five Dumps: Household and farm equip., stoves, glass, cans, car parts, BS license plate.	Fair	A,D		Harding 2005
10JF398 562395	HE, William Henrie 1913	Household and farm equip. dump	Poor	NE		Harding 2005
10JF399 856094	HE, Charles Perkins 1922	Household and farm equip. dump, large assortment	Poor	NE		Harding 2005
51-017946	Bridge	1938 WPA bridge with basalt abutments, and wood stringers and decking.	Fair	NE		Harding 2005
51-017947 (10JF388)	Irrigation Ditch	Wide shallow irrigation Ditch 8" wide, truncated at either end.	Poor	NE		Harding 2005
51-017948 (10JF395)	Canal and lateral	Canal 30" wide; lateral 12" wide	Fair	A		Harding 2005
51-017949 (10JF397)	Irrigation Ditch	Lateral 12" wide next to road	Fair	A		Harding 2005
2706-14	Canal	Independence Canal, 30" wide, still in use.	Good	A		
HQ	Residence	Camas NWR Headquarters, Refuge Manager House, 1938	Good	A,C	2002	Speulda 2002
HQ	Service Building	Camas NWR Headquarters, Office and garage, 1938	Good	A,C	2002	Speulda 2002
HQ	Shop	Camas NWR Headquarters, Shop, 1938	Good	A,C	2002	Speulda 2002
HQ	Oil Building	Camas NWR Headquarters, Storage building, 1950s	Fair	NE	2002	Speulda 2002
Brown Farm	Farm	Garage, barn, equip. storage, root cellar, well,	Fair	NE	2007	Speulda-Drews 2007

Site/Resource Patent #	Site Type	Description	Integrity	Eligibility[1] A,B,C,D	DOE[2]	Surveyor/ Report Author, Date Recorded
		corral—no house.				
Quarters #2	Residence, garage	Bramwell house and garage, 1930s, moved 1952.	Good	NE	2007	Speulda-Drews 2007

[1]Criteria A, B, C, D based on NRHP.
[2]Determination of Eligibility with SHPO concurrence, need date and verification.

Cultural Resource Surveys

Cultural resource surveys are required whenever the Refuge undertakes a project that will disturb the ground or likely to cause harm to any cultural resources that could potentially be impacted by a project. Archaeological fieldwork on Camas NWR has focused on compliance with Section 106 of the National Historic Preservation Act (NHPA) for a variety of undertakings including developing gravel borrow pits, levee/dike construction or maintenance, canal maintenance, prescribed burns, road development and maintenance, land exchanges, rehabilitation of the Headquarters buildings and Quarters #2, and demolition of buildings. Surveys have been completed by USFWS Cultural Resources Team, private contractors, Idaho Department of Transportation, Bureau of Land Management, and University of Idaho staff. Table 5.3 provides a summary of projects that have occurred on the Refuge. Reports generated by the surveys are cited, when applicable, in the References section of this document. Electronic copies of most of the reports are stored at the USFWS Region 1/Region 8 Cultural Resources Team Office in Sherwood, Oregon. However, reports prepared prior to 1989 or prepared by NRCS are not accessible to researchers at this time.

Table 5.3. Cultural Resource Surveys on the Camas Refuge (by year)

Surveyor/ Report Author	Report #	Date	Type	Acres Surveyed	Project Title/Results
Hill		1980	Survey	5	Class III Inventory for Proposed Dike Construction; lithic scatter, log building.
Butler		1980	Survey	140	Proposed Grain Field Irrigation Improvements; Negative.
Butler		1980	Survey	250	Proposed Marsh and Nesting Developments; Negative.
Butler	1989/1004	1980	Survey	155	Cult. Res. Inventory of Proposed Land Exchange; Negative.
Butler	1989/1006	1984	Survey	5	Cyclical Maintenance of Canals; Negative.
Power	1989/5509	1985	Survey	120	CRCW, Medicine Lodge 3Rd Qtr, BLM; Negative.
Johnson	1989/3214	1987	Survey	270	PSR, Hamer I.C.-Dubois I.C., IDOT; Negative.
Johnson	1989/3215	1987	Survey	14	PSR, Hamer to Dubois Southbound Borrow #4, IDOT; Negative.
Wilde		1987	Survey	1	Blacksmith Shop Removal.
Sappington	1989/6002	1988	Survey	20	Recon. of Three Areas Adjacent to Mud Lake and Camas Creek, Letter Report 88-17.

Surveyor/ Report Author	Report #	Date	Type	Acres Surveyed	Project Title/Results
Hill	1990/50	1989	Survey	40	Joseph Marty Family Trust Bureau Motion Sale, BLM; Negative.
Hill	1991/79	1990	Survey	80	Mickelson Land Use Permit, BLM; Negative.
Hill	1991/84	1991	Survey	80	Mickelson BLM land exchange; Negative.
Hill	1992/422	1992	Survey	20	Buck Springs Livestock Well, BLM; Negative.
Valentine	1994/2	1993	Survey	4	Well #4 Impoundment; Negative.
Harvey	1997/570	1996	Survey	120	Cult. Res. Investigations, Sanders Land Exchange and Bybee Tract Projects; Negative.
Bourdeaux		2000	Survey	1	New house location; Negative
Blackmer	2001/803	2000	Survey	1	Robert Bybee Windbreak, NRCS; Negative.
Burnside	2002/220	2000	Survey	8	Camas Refuge Road Repairs and Pullouts; Negative.
Burnside		2001	Survey	150	Brindley Unit Prescribed Burn; Negative
Burnside	2001/851	2001	Survey	1	New Apple Orchard Road; Negative.
Burnside	2001/852	2001	Survey	3	New Dike Road; Negative.
Burnside	2001/853	2001	Survey	25	Camas Refuge Borrow Areas; Negative.
Sayer	2001/1020	2001	Survey	1	Nextel Partners Cell Tower; Negative.
Harding and Green	2001/1026	2001	Survey	4	50 Clear Talk Cell Towers; Negative.
Speulda	2002/456	2002	Survey	2	Headquarters Evaluation; DOE eligible (3)
Speulda-Drews		2003	Advers e Effect	1	ADA Ramp on Residence.
Valentine	2004/388	2003	Survey	11	Buck Springs Wild Fire Appendix B Report; Negative.
Burnside	2004/385	2003	Survey	3	Interstate-15 Buried Power Line; Negative.
Valentine	2004/386	2003	Survey	8	Independent Wild Fire; Negative.
Harding	2006/289	2005	Survey	83	Camas NWR CRS-7; Negative.
Harding	2006/290	2005	Survey	129	Camas NWR CRS-1 (Buck Springs Revegetation); Negative.
Speulda-Drews	2007/527	2007	Survey	3	Brown Tract and Quarters #2 Evaluation; DOE ineligible.
Harding	2007/870	2005	Survey	2740	Camas NWR Prescribed Burn Parcels; 14 CRs
Hill	2008/637	2008	Survey	1	Mud Lake Water users ROW, BLM; Negative.

5.2 Refuge Facilities

5.2.1 Entrance and Access Points

The administrative facility of Camas NWR can be accessed from Interstate 15 via Exit 150 to the town of Hamer. From Hamer, the turnoff is about three miles north on the Old Butte Highway at an overpass and county road 2350 N. The refuge headquarters is approximately two miles west of the overpass. Two access points for vehicles currently exist: the main access point is from the north via the headquarters at a paved parking lot with an informational/orientation kiosk, brochure box, and comfort station that leads south to the auto tour route; and a second from the south on gravel Country Road 2200 E that connects to the southern portion of the auto tour route.

5.2.2 Boundary Fences and Markers

Currently Camas NWR encompasses 10,806 acres and is marked with refuge signs and a four-wire fence around most of the perimeter. Signs are placed at least one per quarter mile and corners are marked with multiple signs. At the south end of the Refuge, which borders a paved county road and agricultural fields, maintenance of fence has proved difficult over the years as strong spring winds and sand drifts have continually buried fence and signs. Currently the Refuge maintains only boundary signs in this area. Fences must be maintained yearly to prevent livestock on adjacent lands from entering the Refuge. The east side of the Refuge is directly adjacent to Interstate 15 and fences along this boundary prevent access from the Interstate.

5.2.3 Roads and Parking Areas

Camas NWR has a total of approximately 39 miles of roads. Most of these are dirt or gravel. In some stretches dikes built for impounding water act as roads. It appears that most of the roads on the Refuge were created for livestock access before the Service had purchased the property. After grazing was discontinued in 1993, all roads remained open to public vehicle traffic until 2006, when approximately 27 miles of service roads were closed to public vehicle traffic because of disturbance to wildlife. All roads closed to vehicular traffic remain open to hiking, biking, and jogging during the summer and snowshoeing and cross-country skiing in the winter. Horseback riding by grazing permittees was allowed under grazing permits, but has not been allowed since grazing on the Refuge was discontinued in 1993.

A total of 12.8 miles of refuge roads are open to public vehicle traffic: a 6.3 mile auto tour route, which begins south of the paved parking lot at the headquarters site; and 6.5 miles of hunter access roads, which are open to public vehicle traffic during the hunting season. Four hunter access parking lots are provided along these roads.

The auto-tour route has eight interpretive signs placed at strategic locations to enhance visitor knowledge of the surrounding area, history, wildlife, and wildlife management practices, as well as 17 vehicle turnouts where visitors can stop along the way. The auto-tour route has a cutoff that allows visitors to take a shorter, three mile loop if desired. The auto tour route is open year-round to visitors, and the roads are currently maintained via snow plowing in the winter.

5.2.4 Trails

Currently the Refuge has an asphalt walkway that starts at the main entrance parking lot and leads to the main office or continues on to a viewing platform that overlooks Camas Creek. This short (1/2 mile) trail was designed to allow wheelchair access to the creek channel. The overlook is a wooden platform on the bank of the creek with two wooden benches that offer a place to sit and enjoy the creek and observe birds that use the riparian vegetation on the banks of Camas Creek. Also starting from the main entrance parking lot is an unfinished (1/2 mile) gravel walking trail that leads through the old shelterbelt trees at refuge headquarters and provides good access to some of the best birding on the Refuge. This trail was started in 2005 with volunteer labor and the entire loop still needs to be designed and constructed. With the help of volunteer labor the Refuge hopes to complete the 1.3 mile loop within the next three years.

5.2.5 Administrative and Visitor Facilities

The refuge headquarters has three buildings that were constructed by WPA crews in the late 1930s and early 1940s: a welding shop with two storage bays, a heated maintenance building with four bays, and a combination manager's office and residence. All these buildings are of wood construction with lava rock used for siding. Maintenance of the roof, windows and soffits has been done over the years and the buildings remain in reasonable shape. In 2001 a new manager's residence was constructed on the Refuge about one mile from headquarters, and the old WPA-era manager's residence has become the main office. A deck was added on the office's south entrance which includes a ramp for wheelchair accessibility. The old office area is still currently used by seasonal employees and volunteers. The other shop areas are used as storage for refuge equipment.

A new maintenance shop was completed in 2005 with two large vehicle or heavy equipment bays and one drive-through equipment bay. This building is used for most repairs on equipment and vehicles and storage for heavy equipment. Directly adjacent to the shop is a Hazmat building, and two 1,000-gallon fuel storage tanks for unleaded and diesel fuel.

Besides the refuge manager's house, two other buildings exist on the Refuge, both within two miles of the main compound: a second residential building exists that is used as a bunkhouse to house seasonal employees and volunteers of the Refuge, and a cinder block storage building about 1/4 mile east of the Refuge. This building was acquired with the purchase of the property and is still used for extra storage when needed.

A number of general visitor facilities have been constructed on the Refuge, including: an information kiosk; a comfort station with parking lot and Americans with Disabilities Act (ADA)-accessible restrooms at the refuge headquarters; and six hunter parking areas .

5.2.6 Easements and Rights-of-Way

The Refuge has multiple right-of-way agreements with Rocky Mountain Power (formerly Utah Power and Light Company) for power lines that cross or provide electrical service to the Refuge. Periodic updates to these rights-of-way have been carried out for service lines that still exist.

The Refuge also has two water supply ditches (Independent Ditch and Jacket Ditch) that are operated today by the Mud Lake Water Users, Inc. Independent Ditch was in use when the Refuge was established in 1937, and was then operated by the Independent Water Users of Mud Lake, Inc. who had an agreement with the former owner of this property, the Idaho Livestock Corporation. Water that flowed from the Bucks Springs wells (located on just outside the west boundary of the Refuge) is the headwater to Independent Ditch and was used to supply water for downstream irrigation. Water from the Independent Ditch eventually flows into the Camas Creek channel as it nears what is now the Mud Lake State Wildlife Area. Independent Water Users of Mud Lake, Inc. has maintained and deepened Independent Ditch since the Refuge was established.

Jacket Ditch also starts at a well on private land and flows through the Refuge and eventually ties into Independent Ditch, supplying water for downstream irrigators. This ditch was dug sometime in the 1940s and was protested by the refuge manager at the time. For reasons that are unclear, the ditch was allowed to remain and still exists today. It is unclear if a current easement or right-of-way exists for either Independent Ditch or Jacket Ditch on the Refuge. An informal agreement with the

Mud Lake Water Users, Inc. allows them vehicle access via refuge roads to perform maintenance work and regular checks of the Buck Springs wells.

5.2.7 Dikes, Irrigation, and Water Control Structures

As with many refuges, Camas NWR has a complicated network of water control structures. As the Refuge exists today, there are approximately 26 miles of dikes, 34 miles of water delivery ditches, 9 bridges, and 130 water control and/or irrigation structures. Also present and still in use are nine irrigation wells, with seven of these being used exclusively for providing water for wetland habitat. Two irrigation wells are used for sprinkler irrigation of crops produced under cooperative farming agreements to provide short grass habitat and forage for wildlife.

Map 12 (Chapter 4, page 4-53) shows 16 named ponds or sloughs and two lakes. Of these 18 bodies of water, all but four are managed intensively through the use of dikes, water control structures, and wells. A description of these management units is included in Chapter 4, Wetlands.

5.3 Public Use Overview

5.3.1 Open and Closed Areas

Open Areas. Camas NWR is open year round to visitors. The 6.3 mile auto tour route is plowed as needed during the winter to keep it open for vehicle traffic. 27 miles of service roads are open to hiking, biking, jogging, cross-country skiing, and snowshoeing year round, as conditions permit. Camas Refuge also has two public hunting areas for waterfowl and upland game birds. The two areas combined create a total of 2,510 acres of refuge lands open to public hunting.

Seasonally Open Areas. Hiking is permitted off roads, throughout the Refuge, from July 16 through February 28.

Closed Areas. Currently the Refuge does not have areas that are completely closed to public access. Access to some areas is limited by season or type of access (for example, motorized vehicles are limited to the 6.3 mile Auto Tour Route and 6.5 miles of hunter access roads) but the entire Refuge is accessible by some means for at least part of the year.

5.3.2 Annual Recreation Visitors

The area surrounding Camas NWR is composed of farms, ranches, and small rural towns. With a small local population base, it appears that most visitors to the Refuge come from Pocatello and Idaho Falls. Camas NWR is only five miles from Interstate 15 and also draws visitors that are traveling in the area to visit Yellowstone and Grand Teton National Parks. The city of Idaho Falls, 35 miles south of the Refuge on Interstate 15, has been growing in part due to the influence and jobs provided by the Idaho National Laboratory (INL).

Annual visitation before 2007 was estimated at approximately 3,500 visitors per year, however methods used in estimation were not documented. Carver and Caudill's Banking on Nature study (2006) estimated visitation at 6,565 for that year (see Table 5.4 below). In 2007 visitation was estimated at over 6,300. In 2007, a traffic counter was installed at the main entrance to the Refuge. In 2007 visitation was estimated at over 6,300. The traffic counter malfunctioned in 2009 and only provided data for part of the year. Still, the counter recorded 3,202 vehicles during its first five months of operation, and revealed an increase in public use from 2007 to 2009. A new traffic counter was acquired and was functional for the entire year of 2010. In 2010, visitation dropped from 2009. Visitation over the past five years appears to be relatively stable at approximately 6,500 visits annually.

5.3.3 Annual Recreation Visits

Recreational visits differ from overall annual visitors. A visitor is a member of the public coming to the Refuge to participate in an activity. In most instances, a visitor may engage in multiple activities. For example, one visitor may watch birds along the auto tour route, take a walk on the nature trail, and take pictures from various locations. In this example, the visitor actually visited three distinct locations. The activities of the visitor are considered visits. One visitor can register multiple visits in one trip and the annual sum of visits is always more than the number of visitors. Visits are measured by a variety of direct and indirect methods. Since 2007, vehicular visits have been measured by a counter installed at the entrance road. Hunting visits are measured by the number of vehicles parked where hunting areas are accessed. Scheduled tours and other special event visits are directly counted by staff conducting these activities. Other visit numbers may be estimated by staff via informal observations of the frequency of an activity. Also, the types of data and the methods used to capture those data have changed over time so that information collected in the 1970s may not translate well into databases used currently.

Generally, the Refuge does not receive high visitation. Average annual visitation over 2007-2012 was 6,600 (see Table 5.5). The majority of visitors engage in wildlife watching and wildlife photography. Bird watching appears to draw the most visitors, since the Refuge is known locally as a “birding hotspot.” More Idaho State birding records have been captured at the Refuge than at any other site in the State, attracting an increasing number of experienced birders. Wildlife photographers visit the Refuge year-round to photograph a variety of wildlife and scenic views, particularly looking east toward the Grand Tetons mountain range. Elk and white-tailed deer are popular subjects for wildlife photographers, especially during the fall rutting season.

Recreation visits were recorded in 2006 as part of FWS’ *Banking on Nature 2006: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation* report (Carver and Caudill 2007). This is the only study on the Refuge to date, that separates visits from residents versus non-residents. Approximately 60% of visits were by residents while 40% of visits were by nonresidents. In 2006, the Refuge had 6,565 visits, and almost all of the visits were for non-consumptive recreation (wildlife observation, photography, and interpretation). Table 5.4 shows the recreation visits for Camas NWR in 2006. Table 5.5 shows recreation visits and total visitation for the period 2007-2012 from Refuge RAPP reports.

Table 5.4. Camas Refuge 2006 Recreation Visits

Activity	Residents	Non-Residents	Total
Nature Activities			
Nature Trails	225	150	375
Observation Platforms	360	240	600
Birding	1,200	800	2,000
Other Wildlife Observation	585	390	975

Table 5.4. Camas Refuge 2006 Recreation Visits

Activity	Residents	Non-Residents	Total
Other recreation	1,560	1,040	2,600
Hunting			
Small Game	5	0	5
Migratory Birds	10	1	11
Total Visitation	***3,944***	***2,621***	***6,565***

Source: Carver and Caudill 2007.

Table 5.5. Camas Refuge 2007-2012 Recreation Visits and Total Visitation

Activity	2007	2008	2009	2010	2011	2012	Average 2007-2012
Wildlife Obs. (Auto)	4,500	4,800	4,000	5,600	5,500	6,100	5,083
Wildlife Obs. (Foot)	475	650	850	1,000	1,350	1,200	921
Photography	400	450	600	500	650	1,000	600
Envir.Ed. (on site)	100	60	73	100	250	500	181
Special Events	130	150	130	180	120	170	129
Waterfowl Hunting	10	10	8	8	5	6	8
Other migr. bird hunting	--	--	--	2	8	10	3
Upland game hunting	5	5	5	2	12	12	7
Total hunting	15	15	13	12	25	28	18
Total visitation	6,300	7,000	7,512	6,600	5,800	6,400	6,602

Source: USFWS, Camas NWR, Multi-Year RAPP report, August 30, 2012.

5.3.4 Recreation and Entrance Fee Program

The Refuge does not charge entrance fees or other recreation fees.

5.3.5 Accessibility of Recreation Sites and Programs for People with Disabilities

The building now serving as the main office for Camas NWR has a deck built on the main entrance with an accessible ramp for use by people with disabilities. A paved path was constructed from the main entrance parking lot to an overlook of Camas Creek to provide universal access to for visitors to see the creek, observe wildlife, and experience the riparian habitat. In addition to these facilities, a comfort station in the main parking lot is accessible by people with disabilities.

5.3.6 Law Enforcement

Camas NWR receives law enforcement coverage from a full-time officer stationed at the Southeast Idaho NWR Complex office in Chubbuck. This officer is also assigned to the Minidoka, Grays Lake, and Bear Lake NWRs as well as special assignments at other refuges in the region. Refuge Law Enforcement Officers enforce special refuge regulations via periodic patrols of refuge lands, protect resources, and maintain public safety. The most common law enforcement issues encountered are trespass into closed areas of the Refuge, hunting violations (bag limit violations and poaching), hunting without the proper licenses, vandalism (defacing signs), and littering.

5.4 Wildlife-dependent Recreation

5.4.1 Hunting

The National Wildlife Refuge System Improvement Act was passed by Congress in 1997 and identified hunting as a wildlife-dependent, priority public use for the National Wildlife Refuge System. At Camas NWR the waterfowl hunting and upland game hunting programs are operated in a manner that is consistent and compatible with the Refuge’s purposes and goals. These programs contribute to the continuation of America’s traditions and heritage in wildlife conservation and outdoor recreation. This section discusses both waterfowl and upland game hunting, as both programs are small and use the same facilities.

Facilities

The Refuge provides and maintains roads that provide hunters with vehicle access to two separate hunting units. The South Hunt Unit is 1,570 acres and has four mowed grass parking areas with brochure boxes at each area. The North Hunt Unit is 983 acres and has two designated parking spots in addition to mowed space. There are also 6.5 miles of unpaved hunter access roads on the Refuge.

Hunt Program History

Upon refuge establishment in 1937, hunting was not allowed on the Refuge. A 1,000-acre public hunting area was opened for the first time on Camas NWR in 1957 (22 FR 5898, July 25, 1957). In 1960, waterfowl hunting was closed on the Refuge due to lack of hunting demand and some concern that pressure on the birds was sending them farther south and leaving less available later into the hunting season. However, in 1960 antelope hunting was allowed on the Refuge for the first time, due to high populations and the number of depredation complaints received by the Idaho Department of Fish and Game. In 1961, waterfowl hunting was reopened on the Refuge. Antelope hunting was allowed for another year, but closed in 1962. In 1962, approximately 2,240 acres of the Refuge were opened to the public for pheasant hunting for the first time.

In 1965, there was a significant expansion of the hunting area on the Refuge with the opening of 2,340 acres around Rays Lake; however, this fluctuated over the coming years. Both the waterfowl and pheasant hunting areas were combined for a total of approximately 3,440 acres open to hunting. Antelope hunting was again allowed on the Refuge in 1967 on approximately 1,100 acres, but was closed again in 1972 due to declining numbers on the Refuge. Since the closure of antelope hunting in 1972, no big game hunting has occurred on the Refuge.

Sage-grouse were added to the species of upland game birds that were huntable on the Refuge in 1969. In 1972, hunting around Rays Lake was closed to provide sanctuary for Canada geese. Since geese numbers were growing, hunters had ample opportunities to harvest birds as they left the Refuge to feed.

Sixty chukar partridges were released on the Refuge in 1940 and 30 Hungarian partridge were released in 1941. The chukar partridges left the Refuge not long after the release and headed for higher country, and no other attempts were made to establish a population of this species on Camas NWR. Other releases of Hungarian partridges have occurred on the Refuge since 1941, although the birds have not consistently stayed on the Refuge. Many of the releases were done by groups that used the Refuge for dog trials over the years, especially in the 1960s and 1970s. Dog trials are no longer allowed on the Refuge.

Number of Hunters and Harvest Statistics

The first year waterfowl hunting opened on the Refuge (1957), refuge employees checked 130 hunters, according to the annual narrative (Camas Migratory Waterfowl Refuge 1957). This level of use has not been sustained over time. Waterfowl hunting is a small program, and it is estimated that waterfowl hunters total less than 15 hunters per year. From 2007-2012, there were an average of 8 waterfowl hunt visits per year.

Current Hunt Program

Waterfowl and upland game hunting are allowed on Camas NWR today, in two different units that total 2,510 acres. Ducks, geese, coots, mergansers, snipe, pheasants, and sage-grouse may be hunted. All other species of wildlife are protected and may not be harvested. Hunting is in accordance with Idaho, Federal, and refuge regulations. Approved non-toxic shot is required for hunting all species. During hunting season, waterfowl hunters may enter the Refuge one hour before legal hunting hours. Official shooting hours are from 1/2 hour before sunrise until sunset (Standard Time), in accordance with Idaho Department of Fish and Game regulations. Temporary blinds of natural vegetation may be constructed, but such blinds shall be available for general use on a first-come, first-served basis. Construction of permanent blinds is prohibited and all personal property, including decoys, must be removed from the Refuge at the end of each day. The Refuge allows a youth hunt according to Idaho State regulations. The youth hunt usually occurs on the weekend prior to the regular hunting season opener.

Currently, hunting is not a popular activity on the Refuge. Waterfowl hunting opportunities are low to almost non-existent, since the lowering of the groundwater table has made it difficult to hold water in the hunt area during fall migration. When water is flowing through the main diversion or Independent Ditch, there are some opportunities to jump shoot waterfowl, and a handful of hunters may attempt this per year. Better opportunities exist when waterfowl leave the refuge wetlands in the morning and evening to feed on private agricultural fields.

Opportunities to hunt upland game birds are also minimal due to low populations of sage-grouse, ring-necked pheasants, and Hungarian partridge. Sage-grouse still use the Refuge, but by the time the hunting season starts, most of the birds have moved off the Refuge to private irrigated alfalfa fields to prepare for the coming winter. Populations of game birds are cyclical, and numbers of pheasants and partridges have been increasing in recent years. If the numbers continue to increase, hunters would again have opportunities to hunt upland game birds on the Refuge.

Big game hunting has not been allowed since 1972. Very few requests for big game hunting have been made over the years. The Refuge currently acts as a sanctuary for elk during the regular State hunting season, and has hosted about 120-130 elk in the winter in recent years. A limited big game hunting program is proposed in the Preferred Alternative of the Draft CCP/EA (see Chapter 2).

5.4.2 Fishing

In 1954, the Idaho Department of Fish and Game officially opened Camas NWR to fishing; however, fishing was not allowed by the Refuge. In the same year, IDFG used liquid Rotenone to poison fish in Mud Lake, refuge lakes and ponds, and Camas Creek and then stocked Camas Creek and Mud Lake with trout the following year (1955). Sport fishing has never been opened as a public use on Camas NWR due to a lack of adequate fishing opportunities as a result of inconsistent water flows in Camas Creek and low water levels on the Refuge in lakes and ponds.

5.4.3 Wildlife Observation and Photography

The vast majority of visitors to Camas NWR today participate in wildlife observation and photography. Camas NWR is one of the premier birding spots in Idaho and has the distinction of more rare bird sightings than any other location in the State. Motorized vehicles (on the auto tour route only), hiking, bicycling, cross-country skiing, and snowshoeing are all available modes of engaging in wildlife observation and photography. Pets are allowed on the Refuge while on leash or under the control of the owner.

Facilities

There are a number of facilities that support wildlife observation and photography activities on the Refuge. There is a 1/2 mile birding trail at the headquarters. Shelterbelt habitat, consisting of both native and non-native trees and shrubs, is maintained to provide habitat for migrating songbirds. There is one observation platform on the banks of Camas Creek that offers visitors another opportunity to observe wildlife and unique refuge habitat. The 6.3-mile auto tour route is open to motorized vehicles and all non-vehicular uses. Along the auto tour route, there are six designated parking areas to allow visitors to pull off the road and observe wildlife from their vehicles safely. A number of panels and pullouts are also available for visitors. In addition to the auto tour route, there are also approximately 27 miles of dirt and/or gravel service roads that are open year-round to nonmotorized uses. Hiking off-road is allowed throughout the Refuge from July 15 through February 28; portable photography blinds may be used as long as users obey closure dates.

Program Details

A wildlife list brochure, produced in coordination with the Audubon Society and other subject material experts, is available at the headquarters and provides an excellent source of information for wildlife viewing. Along the auto tour route, visitors can observe wildlife around the core marsh areas, with views of several different habitat types and wetlands. Spring and fall migration provide the best opportunity to view and photograph wildlife.

One the highest visitor use periods on the Refuge is in late March, during spring migration when the waterfowl return to the area enroute north to their breeding grounds. Tundra swans numbering in the hundreds can be seen from various locations on the Refuge. The arrival of the snow geese is the most popular viewing opportunity for visitors, as 10,000 to 15,000 geese typically crowd into the limited open water in the Refuge's core marsh area, and are visible from the auto tour route.

Another popular opportunity occurs in late fall when the white tailed-deer begin their rutting activity on the Refuge. This event is particularly popular with photographers looking to photograph large bucks in daylight conditions. In addition to the spring and fall seasons, Camas NWR also has wildlife viewing in mid-winter when bald eagles return to their night roosts in large cottonwood trees near the refuge headquarters. Up to 85 eagles have been observed in these trees at one time, but typically numbers peak between 40 and 50. Visitors who are willing to brave the cold can enjoy the sights and sounds of bald eagles flying in to roost at sunset.

5.4.4 Environmental Education

Currently there is no dedicated refuge staff or facilities to support environmental education. Since the Refuge was established in 1937, it has been part of the refuge managers' duties to schedule environmental education activities with schools and special interest groups to promote and educate groups about the Refuge. In the early years of refuge establishment, managers visited different club or organizational meetings (such as sportsmen's groups, Rotary Clubs, etc.) and also conducted tours and school programs as requested.

Currently, with no visitor services staff for the Refuge or the Refuge Complex, and a small number of volunteers, EE and interpretation programs on the Refuge are limited. Requests to accommodate both local and area public schools, university groups, and area community service organizations has increased substantially over the years, although total demand has been relatively low due to lack of promotion and travel funding in recent years by school districts. The refuge manager provides tours to Scout groups on request, providing 6-10 tours that serve approximately 150-200 Scouts annually. In the fall of 2010, a few retired teachers initiated a volunteer program at Camas NWR aimed at providing educational opportunities and primarily hosted Boy Scout groups, reaching an additional 250 students and Scouts annually. In 2011, volunteers conducted environmental education for 250 students and Scouts; in 2012 this number jumped to 500, which was due to an increase in group size (number of groups remained the same). Currently, the volunteers are continuing to conduct outreach to expand this program for the future.

5.4.5 Interpretation

Interpretive panels along the Refuge's auto tour route provide opportunities for visitors to learn about to the Refuge's wildlife and resources. Ten panels were installed along the route in 2004. Topics covered in the interpretation program include: farming for wildlife, wetlands management, sources of refuge water, geographic features, Brindley Barn, Camas Creek wildlife and habitats, swan nesting, muskrat management, cooperative habitat restoration, colonial nesting birds, and uplands ecology. As with environmental education programs, there is no dedicated refuge staff to conduct interpretation, but the refuge manager conducts interpretive programs upon request.

5.5 Illegal Uses

Camas NWR has a history of sporadic illegal activity. One of the major concerns is poaching of big game animals such as white-tailed deer and elk, particularly trophy class or larger-sized deer and elk; however this is a fairly small problem. Other issues include: trespass into closed areas of the Refuge; hunting in closed areas; driving vehicles on closed roads; visiting the Refuge after dark when closed; trespass of cattle belonging to nearby landowners onto refuge lands; off-road vehicle use; and vandalism to signs, gates and fences. Illegal uses persist partly because of the remoteness of the Refuge and limited law enforcement capability.

5.6 Area Outdoor Recreational Opportunities and Trends

5.6.1 Nearby Recreational Opportunities

The Refuge is located 35 miles north of the city of Idaho Falls and five miles west of Interstate 15 in Jefferson County and is within 100 miles of the entrances of Yellowstone National Park and Grand Teton National Park. These two major attractions lie just to the east in the States of Wyoming and Montana; the Grand Teton mountains are visible from the Refuge on clear days. Due to its location along a major highway and in close proximity to the national parks, Camas NWR receives a fair number of national and international visitors.

Eastern Idaho provides vast opportunities for a variety of hunting and fishing activities. In particular, the area is known for its big game hunting opportunities, including white-tailed and mule deer, elk, moose, antelope, bear, and other species. The Snake River Plain also provides opportunities to hunt birds such as ducks, geese, cranes, and upland birds such as pheasants, Hungarian partridge, turkeys, and forest grouse. The area boasts rivers, lakes and streams that provide high quality fishing opportunities. Excellent fly-fishing opportunities for a variety of trout species exist on the Henry's Fork, North Fork, and South Fork. The area also contains reservoirs such as Henry's Lake, Island Park Reservoir, and Palisades Reservoir that provide opportunities for fishing, boating, and other water sports.

Both the Forest Service (FS) and Bureau of Land Management (BLM) own thousands of acres within a short distance of the Refuge. In Jefferson County, about 51 percent of the land is public land (Idaho Department of Parks and Recreation [IDPR] 2006). A small portion of Jefferson County is included in the Targhee National Forest, which provides a variety of outdoor activities for the public, including off-road vehicle (ORV) use, hiking, horseback riding, hunting, fishing, camping, and photography. The BLM owns thousands of acres of high desert habitat within the Snake River Plain, including land adjacent to the western refuge boundary. Approximately 25 percent of Jefferson County is BLM land (IDPR 2006), where visitors can enjoy hunting, fishing, camping, hiking, ORV use, horseback riding, and photography. A popular BLM recreational opportunity with local residents is the St. Anthony Sand Dunes-Egin Lakes Access near St. Anthony, ID, about 30 miles east of Camas Refuge. This area of pure sand dunes is open in places to ORV use and attracts many enthusiasts during the summer.

The Idaho Department of Fish and Game also operates various Wildlife Management Areas (WMAs) within the region. Two that are very close to Camas NWR are Mud Lake WMA to the west, and Market Lake WMA to the southeast. Both of these WMAs provide opportunities to hunt waterfowl, deer, elk, and upland game birds, including pheasants. These areas are also frequented by birders and photographers.

5.6.2 Outdoor Recreation Rates and Trends

The Idaho Department of Parks and Recreation (IDPR) produces the Idaho Statewide Comprehensive Outdoor Recreation and Tourism Plan (SCORTP), under the direction of the Idaho SCORTP Task Force. The Task Force is comprised of representatives from public and private organizations statewide with interest in outdoor recreation. The plan, which is required by the National Park Service (NPS) in order to maintain eligibility for participation in the Federal Land and Water Conservation Fund (LWCF) program, is produced every five years. The plan includes a statewide assessment of outdoor recreation supply and demand, public involvement, and a wetlands component. For the 2006-2010 SCORTP (IDPR 2006), the IDPR surveyed Idahoans statewide to determine their participation in a wide range of recreational activities, and to get a sense of the public's priorities on issues related to outdoor recreation. In addition, staff reviewed other statewide studies related to outdoor recreation conducted during the past five years.

Current Participation Rates. The 2006-2010 Idaho SCORTP (IDPR 2006) and associated recreation survey identified a number of major categories (activity areas) of outdoor recreation, subdivided into recreational activities. Survey results were organized statewide as well as regionally, with Jefferson County included in the Region 6 study area for SCORTP. Walking was the most popular outdoor recreation activity in both Idaho and in Region 6, with 78.4 percent of adult Idahoans and 80.7 percent of Region 6 adult residents walking for exercise or pleasure. Idahoans also participate in wildlife-dependent recreational activities, including hunting, fishing, wildlife observation, and photography. Idahoans and residents in Region 6 participate in these activities about the same amount, although Region 6 had slightly higher participation in shore fishing due to the availability of rivers and streams to access (65.5 percent for Region 6 versus 57.5 percent for Idaho) and watching wildlife other than birds or fish (66.6 percent for Region 6 versus 63 percent for Idaho). Residents in Region 6 in particular had high participation in cross-country skiing, at 26.9 percent for the region versus 16.6 percent for the State. Compared to national participation rates, Idahoans participate in waterfowl hunting nearly six times as often. Non-consumptive wildlife activities, such as wildlife viewing, were also higher than the national average. Table 5.6 shows statewide and Region 6 participation in activities that are currently allowed on the Refuge.

Table 5.6. Participation Rates for Selected Outdoor Recreational Activities in Idaho and Idaho Region 6 (includes Jefferson County)

Recreation Activity	Rank	Idaho Adult Residents Participation	Idaho Region 6 Adult Residents Participation
Nature Activities			
Observe wildlife other than birds, fish	2	63.0%	66.6%
Viewing fish		36.9%	40.3%
Bird watching	5	46.5%	45.4%
Outdoor photography	4	47.5%	47.6%
Hunting			
Waterfowl hunting		12.9%	15.5%
Upland or small game hunting		26.5%	24.5%
Walking/Hiking			
Walking for exercise or pleasure	1	78.4%	80.7%

Hiking	3	59.5%	63.4%
Cross-country skiing		16.6%	26.9%
Snowshoeing		16.5%	17.2%

Note: Table includes those recreational activities which are currently allowed on the Refuge.
Source: Idaho participation rates from 2004 Outdoor Recreation Needs Assessment, reported in Idaho SCORTP (2006).

The most recent National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (FHWAR) was conducted in 2006. The Survey collects information on the number of anglers, hunters, and wildlife watchers; how often they participate; and how much they spend on their activities in the United States. The 2006 Survey found that 1.0 million Idaho residents and nonresidents 16 years old and older fished, hunted, or watched wildlife in Idaho. Of the total number of participants, 350,000 fished (35 percent), 187,000 hunted (18.7 percent), and the majority, 506,000 (50.6 percent), participated in wildlife watching activities, which include observing and photographing wildlife (see Table 5.7). The sum of anglers, hunters, and wildlife watchers exceeds the total number of participants in wildlife-related recreation because many individuals engaged in more than one wildlife-related activity.

Table 5.7. Participation in Wildlife-dependent Recreational Activities in Idaho, 2006.

Activity	Residents and Nonresidents	Idaho Residents	Nonresidents
Wildlife watching (away from home)	**506,000**	**179,000**	**326,000**
Observe wildlife	441,000	175,000	265,000
Photograph wildlife	265,000	110,000	156,000
Freshwater Fishing	**350,000**	**206,000**	**144,000**
Rivers and streams	240,000	132,000	107,000
Ponds, lakes, and reservoirs	220,000	150,000	70,000
Hunting	**187,000**	**122,000**	**65,000**
Small game hunting	55,000	28,000	27,000
Migratory bird hunting	42,000	22,000	--

Note: Activities are ranked by popularity by total participation, in descending order. --Residents/nonresidents grouped in these data sets.
Source: 2006 National Survey of Fishing, Hunting, and Wildlife Associated Recreation-Idaho (USFWS and U.S. Census Bureau 2008).

A comparison of national hunting and fishing estimates for 1991 to 2006 based on the FHWAR survey shows declining participation over the entire time period. In 1991 and 1996, the number of people who hunted and fished remained essentially unchanged. In 2001, the number of sportspersons fell compared to the two previous survey estimates. In 2006, the number of anglers continued to decline and the number of hunters was stable. There were differing trend lines from 1991 to 2006 for wildlife watching. The number of overall wildlife watchers decreased 17 percent from 1991 to 1996, increased 5 percent from 1996 to 2001, and increased 8 percent from 2001 to 2006. Away-from-home wildlife watching dropped from 1991 to 2001 (21 percent from 1991 to 1996 and 8 percent from 1996 to 2001) and stayed level from 2001 to 2006 (the 5 percent increase was not statistically significant).

Forecast of Future Regional Recreation Demand and Key Recreation Needs. Although the 2006 Idaho Outdoor Recreation Survey established baseline data for recreational activities in the State, trend data have not yet been developed. Bowker et al. (1999) developed projection models for the publication *Outdoor Recreation in American Life: A National Assessment of Demand and Supply*

Trends (1999). It is the only ongoing, comprehensive assessment of outdoor recreation trends in the country. The researchers created models based on today's behavior as sampled through the National Survey on Recreation and the Environment (NSRE; NSRE 2000-2002). The following activity participation projections in Table 5.8 from that study are for the Rocky Mountain Region (state by state projections are not available).

Although projections should be viewed with caution, it seems likely that demand for many outdoor activities that are generally permitted on refuges will continue to increase over the next decade. Based on the 2002 Idaho recreation survey, walking, bicycling and recreation with dogs are increasing in popularity, and this trend is expected to continue long term. Data presented in the 2012-2016 Idaho SCORP (IDPR 2012) shows that Bowker's projection of increases in these activities were correct, however in most cases the amount of increase through 2011 was greater than projected (see Table 5.10 below).

Table 5.8. Participation Projections for Selected Outdoor Recreation Activities in the Rocky Mountain Region. (From Bowker et al. 1999)

Activity	2010	2020
Wildlife-related activities		
Nonconsumptive uses (wildlife obs./photography)	+20%	+30%
Hunting	+5%	+12%
Fishing	+16%	+26%
Dispersed Land Activities		
Hiking	+15%	+24%
Horseback riding	+13%	+23%
Developed Land Activities		
Walking	+18%	+28%
Biking	+17%	+26%
Picnicking	+18%	+28%
Winter Activities		
Cross-country skiing	+31%	+41%

The IDPR began gathering baseline data on outdoor activities in 2002. Data used for the 2006-2010 SCORTP (IDPR 2006) were gathered mostly in 2004 and 2005. Even in the short amount of time data was collected, public preferences changed in some areas. Participation in outdoor photography increased significantly (44 percent). Of Idahoans surveyed in 2005, 70 percent participated in outdoor photography. Additionally, more than half of Idahoans were considered "regular participants" or "enthusiasts." This increase was likely due to the emergence of digital photography, which makes photography easier and less expensive than it was before digital cameras were readily available. The rise in popularity of digital cameras likely fed the increase in wildlife viewing (21 percent) and bird watching (29 percent). Table 5.9 below illustrates these trends for selected activities occurring on the Refuge; only activities with at least a 10 percent increase or decrease in participation are listed.

Table 5.9. Idaho SCORTP Statewide Trends in Selected Outdoor Recreation Activities, 2002-2005

Activity	Percent Change (2002-2005)
Outdoor photography	+ 44%
Bird watching	+ 29%
Snowshoeing	+ 28%
Watching wildlife (other than fish)	+ 21%
Classic cross-country skiing	+ 15%

Note: Table includes those recreational activities which are currently allowed on the Refuge.
Source: Idaho SCORTP (IDPR 2006).

Idaho's 2012-2016 SCORP (IDPR 2012) compiled data on participation in various outdoor recreation activities in Idaho from the National Survey on Recreation and the Environment (NSRE) from 1994 through 2011. The data show that participation in most outdoor activities increased over this period. The largest increases were in kayaking, use of personal watercraft, canoeing, anadromous fishing, snowboarding, sledding, and viewing and photographing fish. The few exceptions to the general trend of increasing participation in outdoor activities included inline skating (-75%), windsurfing (-7.4%), mountain biking on trails (-10%) and horseback riding on trails (-14.8%). Data for the activities permitted at Camas NWR are shown in Table 5.10 below. Of the activities permitted on Camas NWR, there were substantial increases in most activities, with the greatest increase in "viewing and photographing wildlife other than birds" (+102.8%). This would include viewing and photographing big game animals such as deer, elk, and moose.

Table 5.10. Participation Trends of Idaho Region* Residents in Selected Outdoor Activities, 1994 to 2011. Activities allowed at Camas NWR are listed. Source: IDPR 2012.

Activity	1994-1995			2000-2001			2005-2011			% change 1994-2011
	Sample size	%	Participants (1,000s)	Sample size	%	Participants (1,000s)	Sample size	%	Participants (1,000s)	
Migratory bird hunting	3,015	3.0	331.2	3,003	4.3	531.0	2,199	4.1	611.2	+84.5
Big game hunting	3,015	11.4	1,279.8	2,490	15.9	1,975.7	733	15.0	2,217.1	+73.2
View or photograph birds	3,015	28.3	3,179.1	2,998	37.1	4,603.1	2,166	40.1	5,913.6	+86.0
View/photo other wildlife	3,015	39.5	4,432.7	2,983	57.9	7,192.2	2,140	61.0	8,987.7	+102.8
Day hiking	3,015	37.2	4,166.6	2,999	48.1	5,969.0	1,256	53.4	7,872.7	+88.9
Bicycling (on improved roads)	3,015	30.3	3,400.7	3,002	45.5	5,654.7	1,465	38.9	5,737.9	+68.7
Snowshoeing	0	.	.	753	3.9	488.3	734	5.1	758.3	+55.3
Cross country skiing	3,015	5.8	651.2	2,489	7.3	903.9	1,484	5.2	767.1	+17.8

*Idaho Region = Idaho and surrounding states: Montana, Nevada, Oregon, Utah, Washington, Wyoming. (Sample size, percent participating, number of people age 16 and older participating, and percent change, 1994-2011.) 1994-1995 number of participants based on 1995 estimate of 11.214 million people age 16 & older (Woods & Poole Economics, Inc.). 2000-2001 number of participants based on 12.415 million people age 16 & older (2000 Census). 2005-2011 number of participants based on 14.745 million people age 16 & older (2009 Census estimate).

Trends in Waterfowl Hunting in Idaho. The number of duck hunters in Idaho declined in the 1980s, due to declines in duck populations due to low nesting success, and consequently more restrictive seasons and bag limits. As duck populations recovered, hunters returned to the sport, though not in the numbers seen in the 1960s and 1970s. Overall, the number of waterfowl hunters in Idaho has increased since the late 1980s. A near doubling of the length of the duck season in 1995-1996, from 59 days in 1990 to 107 days in 1996, as well as more liberal daily bag limits (from 4 ducks in 1994 to 7 ducks from 1996 on) led to larger numbers of ducks harvested, as well as increasing numbers of participants in waterfowl hunting. Although the length of the goose season and bag limits increased only slightly in the same period (from 93 days in 1990 to 107 days in 2003, daily bag limit from 3 to 4 geese) goose harvests also rose significantly. Numbers of Duck Stamps sold in Idaho rose from approximately 17,000 in the late 1980s and early 1990s, to approximately 25,000 in the early to mid-2000s. Harvests rose from 113,000 ducks and 27,000 geese in 1988, to more than 200,000 ducks and 75,000 geese in the mid-2000s (Table 5.11, IDFG 2009).

Table 5.11. Estimated Waterfowl Harvest Numbers from USFWS's Waterfowl Hunter Survey for Idaho, 1988-2006.

Year	Duck Stamps Sold	Estimated Adult Hunters	Total Geese Harvested[1]	Total Ducks Harvested[1]
1988	16,597	14,271	26,600	112,900
1989	16,894	14,073	30,500	119,600
1990	17,036	13,443	36,800	96,700
1991	17,151	14,144	39,500	117,880
1992	17,717	14,132	31,700	126,700
1993	21,761	17,972	45,600	153,200
1994	21,229	17,418	61,100	141,300
1995	21,097	18,395	46,900	203,400
1996	22,382	19,751	61,100	245,800
1997	23,697	22,241	40,700	248,600
1998	23,515	21,006	56,700	254,700
1999	26,709	20,795	28,500	228,300
2000	28,206	23,306	86,200	173,200
2001	26,173	12,000/14,900[2]	64,400	138,600
2002	24,937	14,500/9,900[2]	36,700	160,600
2003	24,878	18,200/15,400[2]	84,200	262,900
2004	24,320	17,100/13,300[2]	62,700	188,500
2005	23,724	18,500/16,000[2]	74,300	258,300
2006[3]	25,726	18,400/14,500[2]	77,800	278,000

Source: IDFG 2009.
Notes: [1]Adjusted for exaggeration memory bias and juvenile hunter density.
[2]The first number is estimated number of duck hunters and the second number is estimated number of goose hunters.
[3]Preliminary estimate July 2007.

5.7 Social/Economic Environment

5.7.1 Population, Housing, and Income

Camas NWR is located in eastern Idaho in Jefferson County. The Refuge is situated north of Idaho Falls, the largest city in eastern Idaho. Idaho Falls is the seat of Bonneville County, but Jefferson County is considered part of the Idaho Falls Metropolitan Statistical Area. Madison County borders Jefferson County and is close to the Refuge. As such, the local study area includes the tri-county area of Jefferson, Bonneville, and Madison counties. Table 5.12 shows the population and demographic statistics for the area around the Refuge.

Since 2000, Jefferson County's population has steadily increased. Between the 2000 and 2010 censuses Jefferson County was the fourth fastest growing county in the State. Since the county is part of the Idaho Falls Metropolitan Statistical Area, it sits between the high-growth counties of Bonneville and Madison, which affects Jefferson since it gets their overflow. Many new residential subdivisions and commercial developments have been added (Idaho Department of Labor 2011a). From 1998 to 2008, the population increased by 28 percent and the per capita income increased by nearly 53 percent (U.S. Department of Commerce 2010). By population, Bonneville County is the fourth largest in the State, and grew 26 percent from 2000 to 2010 (Idaho Department of Labor 2011b). The county has experienced steady growth in the last decade. Idaho Falls, the county's largest city, is the fourth largest city in the State. In addition to population growth, the per capita income in Bonneville County has increased nearly 60 percent from 1998 to 2008. There was also a 12 percent increase in per capita income in Idaho, which matched the national change. Madison County's population increased 37 percent between the 2000 and 2010 censuses, in large part due to growth in the local college's enrollment (Idaho Department of Labor 2011c). Madison County ranked tenth in the State in population.

Table 5.12. Summary of Population and Per Capita Income (population in thousands)

County	Population		Per Capita Income	
	2010[1]	**% Change 2000-2010[1]**	**2009[2]**	**% Change 2000-2009**
Jefferson Co.	26.1	36%	$25,333	30%
Bonneville Co.	104.2	26%	$34,386	48%
Madison Co.	37.5	37%	$17,543	23%
Area Total	*167.8*	*30%*	*$25,754[3]*	*33%[3]*
Idaho	*1,567.6*	*21%*	*$31,857*	*29%*
United States	308,745.5	10%	$ 39,138	33%

[1]Source: U.S. Census Bureau 2010.
[2]Source: U.S. Department of Commerce 2010.
[3] Source: Average from total area per capita income.

According to 2010 census data, Idaho State population generally increased. From April 2000 to April 2010 Idaho ranked fourth nationally in percentage of population growth (21 percent), compared to 10 percent growth nationwide (U.S. Census Bureau 2010, 2011a; Idaho Department of Labor 2010). Along with population growth, population characteristics in Idaho also became more diversified from the 2000 Census to 2010 Census. Although both Idaho and its counties are still less ethnically diverse than the nation as a whole, population demographics diversified from 2000 to 2010, particularly with population growth of American Indian and Alaska Native, Asian, and Native Hawaiian and other Pacific Islanders, which often doubled their percentages. Still, these populations account for less than 10 percent of total population in the counties that also saw significant growth in White populations. Hispanic populations also increased in both Jefferson and Bonneville counties, and significantly in Bonneville County where it more than doubled from 2000 levels. Statewide, Hispanic concentrations have increased in counties within Idaho, as well as central Washington and within the States of Kansas, Idaho, Oklahoma, Nebraska, and Colorado (U.S. Census Bureau 2011b).

Jefferson and Bonneville counties' homeownership rates (83.2 percent and 71.9 percent respectively) are higher than the State averages, while Madison County's was lower (48.2 percent). In 2000, Madison County had more than double the other counties and State level for persons below poverty level (30.5 percent). Jefferson and Bonneville counties had at or below State level of persons with a disability (16.9 percent and 15.6 percent respectively), while Madison County had about half less (9.8 percent). In 2000, Jefferson County had the highest percentage of population with high school degrees in the study area (29.4 percent), while Bonneville County had a slightly higher percentage of population with bachelor degrees (17.3 percent). Table 5.13 shows selected demographic characteristics and social statistics for the study area counties and Idaho.

Table 5.13. Selected Demographic and Social Statistics for Idaho.

Population Parameter	Jefferson County	Bonneville County	Madison County	Idaho	% Change 2000-2010 (Idaho)
White persons, percent, 2010	91.2 %	90.6%	93.9%	89.1 %	18.6%
Black persons, percent, 2010	0.2 %	0.6%	0.5%	0.6%	79.8%
American Indian and Alaska Native persons, percent, 2010	0.8%	0.8%	0.3%	1.4%	21.5%
Asian persons, percent, 2010	0.4%	0.8%	0.9%	1.2%	60.4%
Native Hawaiian and Other Pacific Islander, percent, 2010	0.1%	0.1%	0.1%	0.1%	77.1%
Persons of Hispanic or Latino origin, percent, 2010	10.7%	11.4%	5.9%	11.2%	73.0%
Owner occupied housing units, 2010	83.2%	71.9%	48.2%	69.9%	19.1%
High school graduates, percent of persons age 25+, 2000	29.4%	26.5%	22.3%	28.5%	--
Bachelor degrees, percent of persons age 25+, 2000	11.6%	17.3%	14.4%	14.8%	--
Persons below poverty level, percent, 2008	10.4%	10.1%	30.5%	11.8%	--
Persons with a disability age 21 to 64 years, 2000	16.9%	15.6%	9.8%	16.7%	--

Note: -- No data provided in 2010 Census.
Source: U.S. Census Bureau 2010.

5.7.2 Employment and Business

Employment increased from 2000 to 2009 in all counties in the study area, although Jefferson County had a larger increase in employment than Bonneville and Madison counties and the State. The counties and State had a larger employment increase than the United States. In Jefferson County, many residents commute to neighboring Bonneville or Madison counties, where growth has been substantial. During the last decade, the labor force in Jefferson County grew almost 26 percent, and employment has grown almost 21 percent over the decade. In Bonneville County, the civilian labor force increased by over 21 percent during the decade. From 2000 to 2010, unemployment also increased significantly in all counties and the State, a reflection of the economic climate during the first decade of the twenty-first century. Madison County has maintained one of the lowest unemployment rates in the State. Table 5.14 shows a summary of employment from the study area.

Table 5.14. Summary of Employment, 2008 (employment in thousands)

County	Employment[1]		Unemployment[2]	
	2009	% Change 2000-2009	2010	% Change 2000-2010
Jefferson Co.	9.8	26%	7.8%	167%
Bonneville Co.	59.9	12%	7.0%	152%
Madison Co.	17.5	16%	6.3%	130%
Area Total	*87.2*	*15%*	*6.9%*	*150%*
Idaho	*882.1*	*12%*	*9.3%*	*132%*
United States	173,809.2	5.1%	--	--

Note: -- No data provided in Idaho Department of Labor Work Trend Profiles.
[1] Source: U.S. Department of Commerce 2010.
[2] Source: Idaho Department of Labor 2011a, 2011b, 2011c.

In Jefferson County, government (29 percent), trade (22 percent), manufacturing (16 percent) and construction (9 percent) are the largest industries, with government and trade providing half of the jobs (Idaho Department of Labor 2011b). The Department of Transportation, local officials, and several school districts account for government jobs while two of the area's large potato fresh-pack plants employ many in wholesale trade. Most of the manufacturing jobs are at the two large potato processing plants, Idahoan Foods and Idaho Pacific. Grain, corn and potatoes are produced in the county. Tourism also makes up part of Jefferson County's economy, as the county is a gateway for a number of opportunities: U.S. Highway 20 is a gateway for tourists heading to Island Park and Yellowstone National Park; The Riot Zone, which features recreational activities for the whole family, is situated next to Rigby Lake, which offers picnic sites, day use and swimming; and U.S. Highway 26 attracts tourists traveling to the Targhee National Forest, various ski resorts, Jackson Hole, Wyoming, and the Grand Teton National Park. From 2000 to 2010, total average employment increased by 655, while average annual wages increased by over $5,500.

In Bonneville County, the county has one of the State's largest employment sites, the Idaho National Laboratory (INL). Additionally, the county is a regional health care and retail hub, and the consumer and client bases extend beyond surrounding counties to Wyoming and Montana. A number of professional developments continue to revitalize the county and help diversify their economy. In the county, trade, utilities and transportation (26 percent), educational and health services (17 percent), government (14 percent), and professional and business services from INL (10 percent) are the largest industries, with trade and health services providing half of the jobs (Idaho Department of Labor 2011a). Leisure and hospitality (10 percent) is growing as the county becomes better known. From 2000 to 2010, total average employment increased by nearly 3,400, while average annual wages increased by over $5,700.

In Madison County, trade generates one-fourth of the county's jobs, strong in both retail and wholesale. Health care and education also play a large role, and the hospital sector is expanding as the number of clinics countywide increases. The university is still growing and adding more degree programs, fueling an increase in education employment. In the county, trade, utilities and transportation (22 percent), educational and health services (18 percent), government (14 percent), and professional and business services (12 percent) are the largest industries (Idaho Department of Labor 2011b). From 2000 to 2010, average employment increased by 10 percent and average wages increased by more than 45 percent, with most of the growth in financial activities, educational and health services, trade, utilities and transportation, and government. See Table 5.15 for industry employment averages for Bonneville, Jefferson, and Madison counties, ranked by largest employment sectors for the tri-county study area.

Table 5.15. Average Industry Employment and Wages of Bonneville, Jefferson, and Madison Counties, Idaho.

Industry	Average Employment 2010	Average Wages 2010	Average Employment % Change 2000-2010	Average Wages % Change 2000-2010
Trade, Utilities, and Transportation	5,185	$27,233	11.8%	41.7%
Educational and Health Services	3,348	$34,658	54.2%	51.9%
Government	3,061	$29,921	14.8%	19.6%
Professional and Business Services	1,997	$31,499	−25.1%	21.1%
Leisure and Hospitality	1,960	$10,160	20.9%	30.3%
Manufacturing	1,180	$32,077	−9.1%	38.0%
Construction	1,174	$33,469	−1.8%	49.1%
Financial Activities	789	$33,216	24.2%	43.3%
Agriculture	528	$27,584	−24.2%	43.3%
Other Services	475	$22,392	−2.5%	34.2%
Information	425	$26,622	30.5%	80.1%
Total Covered Wages	*20,142*	*$28,445*	*9.4%*	*30.8%*

Sources: Idaho Department of Labor 2011a, 2011b, 2011c.

5.7.3 Refuge Impact on Local Economies

From an economic perspective, Camas NWR provides a variety of environmental and natural resource goods and services used by people either directly or indirectly (Carver and Caudill 2007). 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. Production and 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*. For this report, the term *economic effects* encompasses both economic value and economic impacts.

Economic value is the economic trade-off people would be willing to make in order to obtain some good or service. It is the maximum amount people would be willing to pay in order to obtain a particular good or service minus the actual cost of acquisition. In economic theory this is known as net economic value or consumer surplus (see Freeman 1993 and Boyle et al. 1990 for a more detailed discussion). In the context of this report, estimates of the economic value of particular recreational activities are used to determine the aggregate value of recreational use of Camas NWR.

Economic impacts refer to employment, employment or labor earnings, industrial or economic output, and Federal, local, county, and state tax revenue that occur as the result of consumer expenditures on refuge-related goods and services. For this report, two types of impacts are addressed: (1) impacts associated with annual consumer expenditures on refuge-related recreation; and (2) impacts associated with refuge budget expenditures.

A comprehensive economic profile (baseline) of the refuges and estimates of the economic effects of alternative management strategies 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 refuges 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.

This 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.

The economic area for the Refuge is the two-county area including Jefferson and Bonneville counties. It is assumed that visitor expenditures occur primarily within this area. Visitor recreation expenditures for 2006, the last available information, are shown in Table 5.16. Total expenditures were $107,300 with non-residents accounting for $75,800 or 71 percent of total expenditures (Carver and Caudill 2007). Expenditures on non-consumptive activities accounted for almost all of the expenditures.

Table 5.16. Visitor Recreation Expenditures at Camas Refuge (2006 $,000)

Activity	Residents	Non-Residents	Total
Total Non-Consumptive	$31.2	$75.7	$106.9
Total Hunting	$0.3	$0.1	$0.4
Total Fishing	--	--	--
Total Expenditures	**$31.5**	**$75.8**	**$107.3**

Input-output models were used to determine the impact of expenditures on the local area. Table 5.17 summarizes the local economic effects associated with recreation visits. In 2006, final demand totaled $110,800 with associated employment of two jobs, $91,900 in employment income, and $14,400 in total tax revenue (Carver and Caudill 2007).

Table 5.17. Local Economic Effects Associated with Recreation Visits at Camas Refuge (2006 $,000).

	Residents	Non-Residents	Total
Final Demand	$33.1	$77.7	$110.8
Jobs	1	1	2
Job Income	$14.2	$77.8	$91.9
Total Tax Revenue	**$4.5**	**$9.9**	**$14.4**

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Chapter 6 Environmental Effects

Chapter 6. Environmental Effects

This chapter provides an analysis of the environmental consequences of implementing the alternatives described in Chapter 2. Impacts are described for the main aspects of the environments described in Chapters 3 through 5, including the effects to physical, biological, cultural, and socio-economic resources. The alternatives are compared “side by side” under each topic, and both the adverse and beneficial effects of implementing each alternative are described.

The overall cumulative effect on the environment from implementing the various alternatives is summarized in section 6.17. Cumulative impacts include a) impacts to refuge resources from reasonably foreseeable events; and b) impacts resulting from interaction of refuge actions with actions taking place outside the Refuge. This discussion includes a brief discussion on potential impacts of climate change to refuge resources. More detailed assessments of the Refuge’s cumulative effects for relevant impact topics are presented section by section.

6.1 Overview of Effects Analysis

The effects analysis has been developed by a) identifying the species groups, habitats, refuge users, aspects of the physical environment, and other resources of interest; and b) identifying effects to these resources that could potentially result from implementing the actions described under each alternative. Effects are described in terms of the change from current conditions. Although minimal or no changes to management programs would occur under Alternative 1 (the no-action alternative), there are still effects because changes from current conditions would be expected over the next fifteen years if current management programs continue. “Neutral effect” in the table and discussion below refers only to cases where conditions are expected to be static over the next fifteen years.

More details on effects from recreational or economic uses are contained within Appendix B, Compatibility Determinations.

The information used in this Draft CCP/EA was obtained from relevant scientific literature, existing databases and inventories, consultations with other professionals, professional knowledge of resources based on field visits, and experience.

The terms identified below were used to describe the scope, scale, and intensity of effects on natural, cultural, social, and economic (including recreational) resources. Effects may be identified further as beneficial or negative.

- **Neutral/Negligible.** Resources would not be affected, or the effects would be at or near the lowest level of detection. Resource conditions would not change from current conditions, or would be so slight there would not be any measurable or perceptible consequence to a population, wildlife or plant community, recreation opportunity, visitor experience, or cultural resource. If an impact is not discussed, it is assumed to be neutral.

- **Minor.** Effects would be detectable but localized, slight, small, and of little consequence to a population, wildlife or plant community, other natural resources; social and economic values, including recreational opportunity, and visitor experience; or cultural resources. Mitigation, if needed to offset adverse effects, would be easily implemented and successful, based on knowledge and experience.
- **Moderate.** Effects would be readily detectable and localized with measurable consequences to a population, wildlife, or plant community or other natural resources; social and economic values, including recreational opportunity, and visitor experience; or cultural resources. Mitigation measures would likely be needed to offset adverse effects. These measures could be extensive, moderately complicated to implement, and probably successful based on knowledge and experience.
- **Significant (major).** Effects would be obvious and would result in substantial consequences to a population, wildlife or plant community or other natural resources; social and economic values including recreation opportunity and visitor experience; or cultural resources within the local area or region. Extensive mitigating measures may be needed to offset adverse effects and they would be large-scale in nature, possibly complicated to implement, and may not have a high degree of probability for success. In some instances, major negative effects would include the irretrievable loss of the resource.

Time and duration of effects have been defined as follows:

- **Short term or Temporary.** An effect that generally would last less than a year or season.
- **Long term.** A change in a resource or its condition that would last longer than a single year or season.

6.2 Summary of Effects

Table 6.1 provides an overview of the effects under each alternative by indicator. Effects are described in terms of the change from current conditions. Although the analysis shows that none of the alternatives would be expected to result in significant effects, some positive (beneficial) or negative effects are expected.

Table 6.1. Summary of Effects under CCP Alternatives

	Alternative 1 (Current Management)	Alternative 2 (Preferred)	Alternative 3
	Effects to Wildlife and Habitats		
Effects to waterfowl and waterbirds	Minor negative effect to waterfowl production on the Refuge due to declining wetland productivity and increased difficulty in hydrating ponds through brood-rearing season	Minor negative effect from a decline in local waterfowl production from the decrease in hemi-marsh habitat; minor positive effect to diversity and abundance of breeding waterfowl and waterbirds from changes to habitat structure and productivity in remaining hemi-marsh. Overall, minor to moderate positive effects to waterfowl and waterbird populations in the Refuge, but no significant effects to local, regional, or flyway waterfowl populations	
	Minor to moderate negative effect from declining availability and/or habitat quality of seasonal wetlands	Moderate positive beneficial effects to migratory waterbirds through increased availability and productivity of seasonal and moist soil wetlands; increased availability of invertebrates and moist soil plants	
	Neutral effect—same agricultural crop management as present.	Negligible effect to migratory waterfowl from change from 80 acres of irrigated alfalfa to dryland alfalfa/grain rotation	Minor effect to migratory waterfowl from change from 80 acres of irrigated alfalfa to 80 acres shrub-steppe
	Minor negative impacts from increased public visitation, wildlife observation and photography; minor to moderate negative impacts from allowing off-road hiking throughout the Refuge July 15-Feb 28	Minor negative impacts from increased public visitation, wildlife observation and photography; minor positive effect from prohibiting off road hiking, requiring leash or electronic collars on dogs	Minor to moderate negative impacts from increased public visitation, wildlife observation and photography; reopening Sandhole Lake road to vehicle traffic; allowing off road hiking on 2,510 acres of the Refuge
	Negligible impacts from refuge waterfowl and upland game bird hunting programs.	Negligible impacts from refuge waterfowl and upland game bird hunting programs; minor negative impacts (disturbance) from elk hunting program	
Effects to threatened and endangered species	No effect		

Table 6.1. Summary of Effects under CCP Alternatives

<table>
<tr><th></th><th>Alternative 1 (Current Management)</th><th>Alternative 2 (Preferred)</th><th>Alternative 3</th></tr>
<tr><td rowspan="6">Effects to wetland habitats and wildlife</td><td>Minor to moderate negative effect—declining productivity of permanent wetlands due to static management and lack of late season water</td><td colspan="2">Moderate positive effects from mimicking more dynamic natural processes that shaped the marsh and managing impoundments that have better capability to use diverted or pumped water, to provide late season water.</td></tr>
<tr><td rowspan="2">Minor to moderate negative effect—declining availability and habitat quality of seasonal and moist soil wetlands, wet meadows</td><td colspan="2">Moderate positive effects from providing seasonal wetland habitat and important feeding and resting habitat for spring migratory waterbirds.</td></tr>
<tr><td colspan="2">Moderate positive effect from increasing temporarily and seasonally flooded smartweed habitat (moist soil) and foraging resources (smartweeds, invertebrates)</td></tr>
<tr><td>Negligible effect to short-cover foraging and grazing meadow wildlife from continuation of haying and irrigation of hay fields</td><td>Negligible to minor effect to short-cover foraging and grazing meadow wildlife from reduction acres of irrigated hay fields</td><td>Minor negative effect to short-cover foraging and grazing meadow wildlife from eliminating irrigation of hayed lands.</td></tr>
<tr><td>Minor to moderate negative effects from encroachment of upland and non-native vegetation due to altered hydrology</td><td colspan="2">Moderate positive benefits from reducing encroachment of upland vegetation and restoring wet meadow hydrology</td></tr>
<tr><td>Minor to moderate negative effects to wetland habitats from altered hydrologic processes, lack of overbank flows</td><td colspan="2">Moderate positive effects from implementation of the Wetland and Riparian Rehabilitation Plan to mimic natural variability in hydrologic processes, while simultaneously conserving groundwater resources and rehabilitating partial riparian habitat function.</td></tr>
<tr><td rowspan="2">Effects to riparian woodland and stream habitats and wildlife</td><td rowspan="2">Minor to moderate negative effect to riparian habitat. Incision of Camas Creek will continue to occur, and the water table will continue to drop. As a result all or</td><td>Moderate positive effects from the management emphasis on riparian habitat rehabilitation.</td><td>Minor positive effect from a co-equal emphasis on upland and riparian habitat rehabilitation</td></tr>
<tr><td colspan="2">Moderate positive beneficial effect to riparian habitat by implementing pilot project by 2017 to lower the banks of Camas Creek at strategic locations to increase the occurrence of natural overbank flooding into refuge wetlands.</td></tr>
</table>

Table 6.1. Summary of Effects under CCP Alternatives

	Alternative 1 (Current Management)	Alternative 2 (Preferred)	Alternative 3
	part of the Refuge's natural wet meadow wetlands would eventually transition to a new drier ecological type.	Moderate positive effect to riparian habitat from the collection of inventory and monitoring data from 2014-2017 to better inform management (e.g., Hydrogeomorphic Assessment, LiDar, digital elevation model)	
		Minor positive effect to riparian habitat from seeking collaborative common ground solutions with the Mud Lake Water Users to ensure the rightful conveyance of Camas Creek waters to Mud Lake while maintaining in-stream woody debris.	
	No riparian restoration; minor to moderate negative effects to riparian obligate species from declining quality of riparian habitat	Moderate positive beneficial effect to riparian obligate species from restoring 80-130 acres of willow riparian habitat associated with Camas Creek.	
	Moderate long-term negative effects to riparian habitat due to continuing incision, headcuts, and gully formation on Camas Creek	Moderate long-term positive effects from the development and implementation of the Camas NWR Wetland and Riparian Rehabilitation Plan and the subsequent stabilization and rehabilitation of Camas Creek incision, headcuts, and gully formation.	
	Neutral effect, environmental education activities limited (same as present)	Minor direct negative effect from increased environmental education activities, but moderate indirect positive effect from increased environmental education upon public appreciation and support for riparian conservation.	
	Minor to moderate negative effect from allowing off road hiking July 15-February 28	Minor negative effect to riparian habitat and wildlife from increased wildlife observation and photography; minor positive effect from eliminating off road hiking	Minor negative effect to riparian habitat and wildlife from increased wildlife observation and photography (opening Sandhole Lake loop); minor positive effect from reducing off-road hiking to 2,510 acres
	No effect; big game hunting currently prohibited on Refuge	Minor to moderate positive effect to riparian habitat from reduced elk browsing pressure due to elk hunting. Minor negative disturbance effect to riparian habitat and wildlife from elk hunting	

Table 6.1. Summary of Effects under CCP Alternatives

<table>
<tr><th></th><th>Alternative 1 (Current Management)</th><th>Alternative 2 (Preferred)</th><th>Alternative 3</th></tr>
<tr><td rowspan="3">Effects to shrub steppe habitat and wildlife</td><td rowspan="3">Neutral effect from approximately the same amount of habitat restoration/rehabilitation and invasive species control as present, and the same level of public use disturbance as at present.</td><td>Minor positive effects from emphasizing wetland and riparian rehabilitation while moving forward strategically with limited upland habitat rehabilitation efforts</td><td>Moderate positive effects from the elevation of upland habitat restoration as a coequal to wetland/riparian rehabilitation</td></tr>
<tr><td>Negligible effect from maintaining stable crested wheatgrass monocultures and only rehabilitating small test plot areas of crested wheatgrass</td><td>Moderate positive beneficial effect from rehabilitation of crested wheatgrass monocultures</td></tr>
<tr><td colspan="2">Minor negative impact and loss of habitat from increased public use infrastructure; minor positive effect from reducing off-road hiking</td></tr>
<tr><td rowspan="4">Effects to shelterbelt habitat and wildlife</td><td rowspan="4">Minor negative effect through gradual loss of large cottonwood trees; and increasing difficulty in supplying irrigation water</td><td>Negligible effect from maintaining shelterbelt habitats at 34 acres</td><td>Moderate positive effect from expanding shelterbelt habitats to 50 acres</td></tr>
<tr><td>Moderate positive effect to shelterbelt habitats from partial groundwater irrigation and development of drip irrigation infrastructure</td><td>Minor to moderate positive effect to shelterbelt habitats from use of groundwater irrigation</td></tr>
<tr><td colspan="2">Minor negative effect to migrant landbirds from resumption of banding efforts; moderate positive effect from site-specific information acquired from avian response to shelterbelt restoration, allowing adaptive management</td></tr>
<tr><td colspan="2">Minor negative effect from increased recreational access, wildlife observation, hiking, and photography</td></tr>
<tr><td colspan="4">Effects to Physical Environment</td></tr>
<tr><td>Effects to soil resources</td><td>Neutral effect; agriculture remains at same level as present.</td><td>Minor to moderate positive effect due to decreased soil compaction from riparian restoration</td><td>Moderate positive effect due to decreased soil compaction from riparian and upland restoration, and reduction of agriculture</td></tr>
<tr><td rowspan="2">Effects to water resources</td><td colspan="3">Minor local negative effects from herbicide use on restored uplands, riparian, and aquatic areas.</td></tr>
<tr><td>Neutral effect to groundwater recharge;</td><td>Moderate positive effect to water conservation and</td><td>Minor negative effect to water conservation and</td></tr>
</table>

Table 6.1. Summary of Effects under CCP Alternatives

	Alternative 1 (Current Management)	Alternative 2 (Preferred)	Alternative 3
	water management same as present.	groundwater recharge from the development of drip irrigation infrastructure for shelterbelt habitats	groundwater recharge from use of groundwater irrigation of shelterbelt habitats
	Minor negative effects from ash runoff due to prescribed burns.		
	Minor negative effects from smoke and particulate emissions due to prescribed burns.		
Effects to air quality	Minor, short-term effects from use of prescribed fire. Negligible to minor negative effects from increased vehicle emissions associated with increased visitation.		
Effects to Social Environment			
Overall visitation	Minor negative effect due to increased demographic trends and rising demand for outdoor recreation, without increase in staffing/facilities	Minor positive effect due to enhanced facilities and staffing to support projected increase in demand for wildlife-dependent recreation.	
Opportunities for quality wildlife observation and photography	Neutral effect—no increase in the number of acres available for wildlife observation and photography; habitat management same as present, no conflicts with elk hunting	Moderate positive effect for quality wildlife observation and photography opportunities from maintaining existing access, expanding birding trail, and increased wildlife tours	Moderate positive effect for quality wildlife observation and photography opportunities from increased road access, trail grooming, expanding birding trail, construction of blinds, and increased wildlife tours
		Minor negative effect from decreased opportunities and user conflicts associated with elk hunt	
Opportunities for quality environmental education	Neutral effect, no changes to EE program.	Moderate positive effect because of additional visitor contact station and multipurpose facilities dedicated to environmental education, and staffing strategies that could result in enhanced volunteer support for the program and increased environmental education opportunities	
Opportunities for quality interpretation	Neutral effect, no changes to interpretive facilities, tours.	Moderate positive effects from development of new interpretive materials (print and electronic media), and increase in guided tours	
Opportunities for quality waterfowl and upland game hunting	Neutral effect due to hunting acres and habitat management remaining the same as present.	Slight positive effect; hunting acres remain same as present but changes to habitat management may improve hunting opportunities over time.	

<table>
<tr><td>Opportunities for quality big game hunting</td><td>No effect—no big game hunting currently allowed on Refuge</td><td colspan="2">Moderate positive effect to big game hunting opportunities both on and off Refuge from initiation of refuge elk hunt. Dispersal of elk from the Refuge may result in increased hunting success by off-refuge hunters</td></tr>
<tr><td colspan="4">Effects to Cultural Resources</td></tr>
<tr><td>Effects to cultural and historic resources</td><td>Minor potential for negative effects from habitat management. Minor positive effects from various proactive measures taken for protection and management of cultural resources.</td><td colspan="2">Minor potential for negative effects from increased habitat management and restoration, including wetland restoration work; upland restoration; disking associated with invasive species control and moist soil management; and from increased trails and public use facilities. Minor positive effects from various proactive measures taken for protection and management of cultural resources.</td></tr>
<tr><td colspan="4">Other Effects</td></tr>
<tr><td>Economic effects</td><td>Neutral effect.</td><td>Minor positive effect due to increased staffing, operational, and visitor expenditures. Minor positive effect due to reduction in elk depredation within GMU 63.</td><td>Minor positive effect due to increased staffing, operational, and visitor expenditures. Minor negative effect due to decreased production of alfalfa and hay. Minor positive effect due to reduction in elk depredation within GMU 63.</td></tr>
<tr><td rowspan="5">Cumulative effects</td><td colspan="3">Negligible to minor positive effects from refuge anticipation and adaptive management responses to climate change.</td></tr>
<tr><td colspan="3">Moderate negative effect from reduced habitat integrity from climate change impacts</td></tr>
<tr><td>Minor positive effect from increased use of conservation partnerships</td><td colspan="2">Moderate positive effects from increased regional conservation partnerships</td></tr>
<tr><td colspan="3">Moderate negative effect from continuation of groundwater pumping, over adjudication, and depletion of groundwater within the Snake River Aquifer</td></tr>
<tr><td colspan="3">Minor negative effect from surrounding land uses of genetically modified organisms and pesticides</td></tr>
</table>

6.3 Effects to Waterfowl and Waterbird Species

Actions within the proposed alternatives that could potentially affect waterfowl and waterbird species or populations include: management of wetlands, uplands, shelterbelt, fire, agricultural (crops and haying), hunting, and non-consumptive public uses. Non-consumptive uses may directly affect habitats through physical alterations or have indirect effects by placing the public in close proximity to waterfowl, thus increasing the potential for disturbance.

6.3.1 Effects to Waterfowl and Waterbirds from Habitat Actions

Wetland Management

The artificially enhanced wetlands of Camas NWR provide important habitats for native waterfowl and waterbirds. These managed refuge habitats are even more important now due to the altered hydrology and continued degradation of many of the natural wetlands and water sources within the Snake River Basalts Region and the Sinks Watersheds. Alternative 1 (Current Management) would maintain 840 acres (range 500-700) acres of consistently deep flooded hemi-marsh wetland habitats, 40-60 acres of seasonally flooded shallow marsh (moist soil), and enhance 60-70 acres of wet meadows over the lifetime of the plan. Both Alternative 2 (Preferred Alternative) and Alternative 3 emphasize managing for more diverse and variable migratory waterbird habitat. These two alternatives would decrease the extent of deep hemi-marsh habitat in the next four years (2014-2017), but increase the extent of shallow marsh and wet meadow habitat. In Alternatives 2 and 3 wetland management practices from 2014-2017 would cause a moderate (250-400 acre) decrease in hemi-marsh habitat, a corresponding 250-400 acre increase in shallow marsh habitat, a moderate 110-160 acre increase in seasonally flooded shallow marsh (moist soil) habitat, and a minor 20-40 acre increase in acres of wet meadow habitat enhanced over the lifetime of the plan. Total acres of open water (736 acres, primarily Sandhole Lake) would remain the same in all alternatives.

Providing deep flooded marsh habitat is the primary management emphasis of Alternative 1 (Current Management). While this would benefit overwater nesting waterbirds (diving ducks and grebes, for example), this management approach would likely occur at the expense of improving riparian habitat function for species such as American avocet, willow flycatcher, greater sage-grouse, and yellow warbler. In Alternative 1, the Refuge would continue to use Camas Creek surface water rights and refuge groundwater pumping rights to spring flood and maintain permanent to semipermanently flooded hemi-marsh wetlands through the summer and fall. The Refuge would continue to deeply flood wetlands in Alternative 1 through a full diversion of Camas Creek surface flow (58.1 cfs from April through July in an average flow year). The Refuge would continue to compensate for surface water seepage into the ground in Alternative 1 with supplemental groundwater pumping to maintain deep wetland habitat through October. Alternative 1 would therefore consistently provide six reliably flooded wetland impoundments for waterfowl and waterbirds (Big, Redhead, Toomey, Spring, Center, and Two-way Ponds). Refuge waterfowl and waterbirds expected to benefit from this approach would include Canada goose, redhead, mallard, and American pelican. While this approach provides “consistent” availability of habitat for deep marsh waterfowl, it does not necessarily provide high quality or “healthy” habitat, as there is little annual variability or diversity in refuge flooding regimes (see section 6.4.1). As a result, productivity of deepwater wetland habitat would be expected to decrease over time under current management, resulting in reduced food resources for waterfowl and waterbirds.

In Alternatives 2 and 3 we would make changes to the depth, duration, and inundation in refuge impoundments in the short term (2014-2017) to increase the variability and productivity of wetlands. The Refuge's hemi-marshes would experience periodic drying or drawdown cycles, which regulate vegetation growth. Ideally, a higher number of smaller open pools (1-25 acres) within emergent vegetation would replace the few large pools (greater than100 acres) ringed by emergent vegetation that result from current management (Alternative 1). An increased interspersion of emergent vegetation and open water would be expected to increase both diversity and abundance of breeding-bird species, especially overwater nesting waterfowl and waterbirds (Kaminski and Prince 1984; Murkin et al. 1982; Weller and Fredrickson 1974; Weller and Spatcher 1965).

Due to changes in water management needed to increase riparian streamflow in Alternative 2 (Preferred Alternative) and Alternative 3, hemi-marsh habitats would decrease by approximately 530-590 acres (64-70 percent decrease from present) from 2014 to 2017. Hemi-marsh would occur within only three of six of the Refuge's "core" wetland basins (Big, Redhead, and Toomey Ponds). These three basins were historically composed of deep marsh habitat before refuge impoundment construction and are presumed to have tighter pockets of hydric soils, which held permanent water when groundwater levels were higher (about 1915 through 1980). However, there would be a corresponding increase in shallow marsh habitat, from current (1,213 acres) to 1,743-1,803 acres, a 44-49 percent increase compared to current conditions.

In Alternatives 2 (Preferred Alternative) and 3, we would perform site-specific assessments, hydrogeomorphic (HGM) modeling, and pilot projects to assemble data and test hypotheses needed to develop a long-term Wetland and Riparian Rehabilitation Plan (WRRP) by 2017. The WRRP, when implemented, would create wetland habitat for a more diverse suite of waterbirds, while simultaneously conserving refuge groundwater resources and rehabilitating partial riparian habitat function of Camas Creek.

In comparison to Alternative 1, the action alternatives (Alternatives 2 and 3) would increase habitat for waterfowl and waterbirds that benefit from shallow wetlands and wet meadows. Alternative 2 (Preferred Alternative) and Alternative 3 would increase seasonally flooded habitat for foraging and breeding migratory birds. In the Action Alternatives (Alternatives 2 and 3) the acreage of shallow seasonally flooded (moist soil) habitat would increase 250-500 percent in comparison to Alternative 1 (150-200 acres in Alts 2 and 3 compared to 40-60 acres in Alt 1). This would increase the availability of moist-soil plants such as smartweed, which provides fall-migrating waterfowl with a quality food source (Gray et al. 1999), and increases production of aquatic invertebrates in spring (Fredrickson and Taylor 1982). Shallow moist-soil wetlands adjacent to hemi-marsh that provides security cover would be expected to receive heavy usage by dabbling ducks, particularly mallards, and result in both increased Refuge populations and increased production of these species. Periodic soil disturbance, as described in the Preferred Alternative (Alternative 2), would substantially increase smartweed production (Gray et al. 1999; Rundle 1981), benefitting both migrating and breeding waterfowl.

Alternative 1 would provide deep marsh nesting waterfowl with ample protection from predators, but lower foraging opportunities for waterfowl and waterbirds, since seasonal wetlands usually supply a much greater abundance of invertebrates (De Szalay and Resh 2000; Euliss et al. 2004). Since invertebrate populations decline with prolonged flooding, the proposed drawdowns of at least two months each year in seasonal wetlands, as proposed in Alternatives 2 and 3, would maintain abundant populations of invertebrates (Fredrickson and Taylor 1982; Reid et al. 1989).

Many studies have indicated that water depth is an important variable affecting the use of wetland habitats by waterbirds (Colwell and Taft 2000; Elphick and Oring 1998; Isola et al. 2002; Velasquez 1992), and this relationship has served as the basis for the guidelines of wetland management (Bolduc and Afton 2004). Water depth directly determines the accessibility of foraging habitats for waterbirds because of the restrictions of their morphology, such as the lengths of legs (for wading birds, Baker 1979; Collazo et al. 2002; Darnell and Smith 2004; Ntiamoa-Baidu et al. 1998; Powell 1987) or necks (for dabbling ducks, Poysa 1983). Larger species, with longer necks, bills, and legs, can feed in deeper habitats than smaller species.

In Alternative 2, non-diving waterbirds, such as wading and dabbling birds, would moderately benefit from 110-160 acre (250-500 percent) increase in seasonally flooded shallow marsh (moist soil) habitat, and the 220-300 acre (11-15 percent) increase in wet-meadow habitats, as they generally require shallow water to forage. In contrast, diving waterbirds require deep water, and would subsequently incur a minor negative impact in Alternative 2. Because wading and dabbling birds are the dominant waterbird groups in the region, the greatest refuge waterbird diversity and density will occur by providing an increase in shallow water, where the depth requirements of different waterbird groups overlap (e.g., 10-20 centimeter [cm; 3.9-7.9 inches]) (Colwell and Taft 2000; Elphick and Oring 1998, 2003; Isola et al. 2002; Taft et al. 2002). Conversely, habitats with deeper water support the greatest density of waterbirds when diving birds are dominant (Stapanian 2003), and where the wetlands provide roosting sites for waterfowl (Hattori and Mae 2001). From a management perspective, the overlap of water depth requirements among waterbird groups suggests that refuge wetlands can be managed to meet the needs of different waterbird groups best in Alternative 2 (Preferred Alternative). At the same time, the Refuge will need to manage certain wetlands exclusively for species associated with the extreme ends of the depth spectrum (e.g., diving waterbirds and small shorebirds), especially where such species constitute a large component of the waterbird community (Taft et al. 2002). The desired future conditions of Alternative 2 allow for a wide range of annual variation in hydroperiod (depth, duration inundation) to occasionally accommodate the life-history needs of waterbirds that require extremely deep or shallow wetlands.

Additionally, wetland productivity is anticipated to increase in Alternatives 2 and 3, due to a more dynamic and variable water management approach. The static water regimes of Alternative 1 would be expected to result in decreasing wetland productivity over time. In comparison to Alternative 1, minor to moderate positive effects are anticipated to both breeding and migratory populations of waterfowl and waterbirds in Alternatives 2 and 3. In Alternatives 2 and 3 refuge wetlands would be managed at different successional stages, thereby positively benefitting waterbird species (Lor and Malecki 2006).

In all alternatives the Refuge will disk and mow either alone, or in combination with herbicide applications to suppress dense emergent vegetation that cannot be controlled with water level management. Mowing and disking can cause direct mortality to various wetland birds, small mammals, reptiles, and amphibians, and indirect mortality or reduced fitness due to loss of cover when dense vegetation cover is removed, until wetland plants re-establish. Disking is only performed when needed to control emergent vegetation and improving wetland plant diversity. The Refuge would reduce impacts of management by delaying disking and mowing operations until after most wetland bird species have completed nesting (approximately July 15).

***Overall Effects of Wetland Management to Waterfowl and Waterbirds*:** While there would be less deepwater and hemi-marsh habitat in Alternatives 2 and 3 than under current management, improved habitat conditions and productivity in the remaining hemi-marsh would support both increased abundance and diversity of overwater nesting waterfowl and waterbirds. The restoration and increase in productivity of seasonal wetland habitat would provide breeding habitat for several species, including mallards, Canada geese, northern shovelers, gadwalls, cinnamon teal, and blue-winged teal. Increased availability and productivity of moist-soil wetlands in fall would be expected to increase foraging opportunities for both breeding and fall migrating waterfowl. Therefore, in comparison to Alternative 1, Alternatives 2 and 3 would improve the quality of wetland habitats for waterfowl and waterbirds while strategically applying reduced water resources. This would be expected to result in minor to moderate increases in productivity, overall abundance, and species diversity of waterfowl and waterbirds on the Refuge.

Upland Management

Few waterfowl and even fewer waterbirds rely upon shrub uplands as nesting or foraging habitat. In Alberta northern pintails have been documented to nest in sagebrush uplands as far away as 1-2 kilometers (km; 0.6-1.2 miles) from water, presumably to avoid nest predators near the water body (Duncan 1987). While long-billed curlews have been noted to nest and forage in sagebrush (Pampush 1980), a general preference for upland habitats of low vertical profile and low vertical density (plant parts/volume/height) was observed; habitats with tall, dense shrubs or weedy annual vegetation were generally avoided (Campbell et al. 1990; Pampush 1993).

In both Alternatives 1 and 2, 113 acres of sagebrush-steppe habitat would be restored, a 4 percent increase over existing conditions. In Alternative 2, the Refuge would not dismiss opportunities for large-scale efforts (as described in Alternative 3), but large-scale upland habitat management would occur only as additional funding and time allows. In Alternative 3, management of upland habitats (sage-steppe and native grassland) would receive equivalent emphasis with wetland and riparian management. A total of 425 acres of upland habitat would be restored, representing a 16 percent increase in this habitat type compared to current conditions. There would be greater positive effects to waterfowl or waterbird species that benefit from the upland management under Alternative 3 than under Alternatives 1 and 2; however, the overall effect would be negligible to minor.

Shelterbelt Management

According to Reinert (1984), the importance of perches for hunting, resting, and feeding of raptors has been documented by several investigators. Gatz and Hegdal (1987) theorized in Colorado that numerous suitable perch sites in immediate proximity to vulnerable prey bases accounted for most use of raptors in tall deciduous trees within riparian corridors. At Camas NWR, bald eagles and other raptors have demonstrated a strong preference for large cottonwood snags as daytime perches. “Healthy” second-growth forests that open along rivers and lakes may appear lush, but provide marginal perch habitat for eagles and other large-bodied raptors. Bald eagles for example, need tall, open perches from which to locate prey. Typically, early-seral hardwood forests, such as small-diameter (less than 30 cm [12 inches]) and black cottonwood are densely branched and not useful as raptor perches (Brown 2002).

Maintaining (Alternatives 1 and 2) or increasing (Alternative 3) cottonwood shelterbelt habitats provides perches or cover for raptors, corvids, or mammals that would prey on refuge waterfowl (Payne 1992). Over the course of the next fifteen years mature cottonwood roost sites would increase as the Refuge manages for over 40 percent composition of mature (greater than 60 feet tall) cottonwoods within refuge shelterbelt habitats. While raptor perches in shelterbelt habitats would increase in Alternatives 2 and 3, only minor increases in predation to refuge waterfowl and waterbirds would be expected.

Fire Management

In all alternatives, prescribed fire would be used in refuge wetlands to reduce stands of dense emergent vegetation and maintain or create areas of open water for birds to forage. Under current management, burning of wetland occurs in spring (March 1-April 15) and fall (September 20-October 30.) Early spring burns (March) are generally ineffective in removing dense emergent vegetation. A shift toward late spring and summer burns followed by floodup, as proposed in Alternatives 2 and 3, would be more effective in controlling tall emergent vegetation. A change in fire management as proposed under Alternatives 2 and 3 would create a more open marsh which will remain free of emergent vegetation for a significantly longer time and increase foraging areas for waterfowl and waterbirds.

Agricultural Crops

All alternatives provide supplemental refuge crops for migratory waterfowl within the Pacific and Snake River migratory corridor. Under all alternatives, croplands would be managed primarily to benefit waterfowl and sandhill cranes, but also other species (e.g. long-billed curlew, Swainson’s hawk, sage-grouse, and white-faced ibis). The Refuge would continue to cultivate small grains crops in all alternatives, since they are less labor and water intensive than a high-energy crop such as corn.

In all alternatives, we would continue to grow 20 acres of small grains to both alleviate local crop depredation problems and provide carbohydrate reserves to migratory birds with the Pacific Flyway. Changes to harvest strategies under Alternatives 2 and 3 (e.g. alternating mowed and unmowed swaths to create a “snow fence,” and planting blocks of rows running perpendicular to one another to ensure that the tops of some rows would be exposed by the prevailing winds during heavy snow) would ensure that grain is more consistently available to wildlife longer into the fall season. There would be a minor positive effect to fall migrating waterfowl and sandhill cranes that forage in grain fields due to changes in mowing practices that would increase availability of grain later in the season.

In current management (Alternative 1) and the Preferred Alternative (Alternative 2), 140 irrigated acres of alfalfa would benefit a variety of species, including white-faced ibis, long-billed curlew, and Swainson’s hawk. However, in Alternative 2 we would convert the Well#9 field to a rotation of dryland small grains and alfalfa, if we lost our cooperative farmer, which would result in an increase in grain production but lower production of alfalfa. In Alternative 3, the Well #9 field would be retired and converted to native sage-steppe habitat. Therefore, there could be a slight negative effect to species such as white-face ibis, long-billed curlew, and Swainson’s hawk that forage in alfalfa under Alternative 2, and a minor effect to these species under Alternative 3. There would be a minor positive effect to fall migrating waterfowl and sandhill cranes that forage in grain fields due to changes in mowing practices that would increase availability of grain later in the season.

Agricultural Haying

In all alternatives, a total of 150 acres of early successional short-stature habitats would be created annually by haying. Under Alternative 1 (Current Management), approximately 330 acres of formerly farmed fields would be flood-irrigated annually, and 150 acres of these fields would be hayed annually. Under Alternative 2, only half of this acreage would be flood irrigated, but 150 acres would continue to be hayed annually. Under Alternative 3 we would cease irrigation of formerly farmed fields and hay 150 dryland acres annually. Potential wildlife benefits of haying include: increased palatability of grasses for grazers, increased invertebrate forage availability and detection rates, reduced physical obstruction, and increased security from predators during grazing or foraging activity (Devereux et al. 2006).

Haying would benefit birds that prefer to forage in short-cover habitat, including species in the Meadow Foraging Guild (e.g., greater sandhill crane, long-billed curlew, Canada goose, western meadowlark, American robin, cattle egret; Grazing Waterfowl Guild (e.g., American widgeon, American coot, gadwall, Canada geese); and Upland Nesting Guild (e.g., long-billed curlew, black-necked stilt, killdeer). Conversely, haying would reduce habitat for birds that select dense cover for foraging and nesting, including species in the Upland Nesting Waterfowl Guild (i.e., northern pintail, mallard, cinnamon teal, northern shoveler, gadwall); the Meadow Nesting Shorebird Guild (i.e., Wilson's phalarope, willet, common snipe); the Secretive Marsh Bird Guild (i.e., American bittern, Virginia rail, sora rail); and the Shallow Over-water Nesting Marsh Bird Guild (i.e., black tern, marsh wren, red-winged blackbird, yellow-headed blackbird, northern harrier).

While increased access to invertebrates is the principal advantage cited for short-cover management practices (Schekkerman and Beintema 2007), an unanticipated effect of short-cover haying is productivity to due reductions in detritus, which sustains much of the biomass and structure of the community (van der Valk 1989). Invertebrate production may also be impeded by litter removal (Magee 1993).

The Preferred Alternative (Alternative 2) is to hay 150 acres annually, and rotate haying operations through different parcels, so that the same units would not get hayed two years in a row. By allowing some time for units to recover, the forage quality and quantity would increase, while unhayed parcels would provide denser nesting cover for wildlife. Under Alternative 2, Canada geese, greater sandhill cranes, snow geese, curlews, and ducks would benefit from refuge haying operations. These groups of birds regularly use refuge habitats during the fall migration. Refuge hay grounds supplement natural food sources and provide undisturbed/safe areas where migrating birds can forage. Under Alternative 2 (Preferred Alternative) we would use less groundwater than Alternative 1 (only 150 acres would be flood irrigated annually) and we would reseed hay meadows that are dominated by quack and brome grass to a more palatable and desirable mix of grasses for foraging and nesting wildlife. Alternative 2 strikes a balance between water conservation and providing short-cover habitat for the wildlife species that benefit from it. Alternative 3 would eliminate irrigation of hayfields, thereby conserving groundwater resources for higher-priority uses. Forage quality and quantity, and invertebrate populations, would be expected to decline. Therefore, mowed dryland hayfields would be expected to be less productive and attractive to wildlife than irrigated fields.

All haying operations involve the use of farm equipment to mow, rake, bale, and transport hay. Several studies show a direct and often substantial impact of the harvesting process on wildlife, especially from the mowing stages, and that this impact depends on the techniques and equipment used, as well as the equipment settings, and the habitat and ecology of each species (Humbert et al. 2009). Birds, mammals, amphibians and reptiles may be temporarily or permanently displaced, injured, or killed. Several studies (e.g. Paullin et al. 1977) suggest that hay mowing mortality is greatest during the first two weeks of July, and that early nesting species are directly vulnerable to mowing. Currently, refuge hay operators cannot initiate mowing or harvest of refuge hay until July 15 to ensure that cutting occurs after the nesting season for grassland species is complete. Alternatives 1 and 2 impart only a slight disturbance and low levels of mortality to nesting birds from haying 150 acres annually after July 15, while still providing habitat for those species that prefer to nest and forage in short cover areas. Unhayed areas would provide rich seed and invertebrate food resources, and taller, denser habitat for upland nesting waterfowl, secretive marsh birds, and shallow over-water nesting birds. Continuation of haying irrigated meadows, as proposed in Alternatives 1 and 2, would predominantly benefit common bird species such as meadow foragers and grazers (Lefranc 1997). Reductions in irrigation of hay meadows (from 330 to 150 acres in Alternative 2 and from 330 to 0 acres in Alternative 3) would reduce productivity of these meadows as well as the quantity and quality of forage and invertebrate resources for meadow foragers and grazers. However a reduction in irrigation would conserve water resources for higher priority uses.

6.3.2 Effects to Waterfowl and Waterbirds from Public Recreational Use (not including hunting)

Conflicts arise when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Anticipated direct impacts of wildlife observation and photography, interpretation, and environmental education include disturbance to wildlife by human presence which typically results in a temporary displacement of individuals or groups. Immediate responses of birds to human activities include departure from site or nest abandonment (Burger 1981; Henson and Grant 1991; Klein 1993; Korschgen et al. 1985; Owens 1977; Taylor and Knight 2003), use of suboptimal habitat (Erwin 1980; Williams and Forbes 1980), altered behavior (Burger 1981; Havera et al. 1992; Klein 1993; Korschgen et al. 1985; Morton et al. 1989; Ward and Stehn 1989), and increase in energy expenditure (Belanger and Bedard 1990; Morton et al. 1989), and physiological changes such as elevated heart rates due to flight, or even death (Knight and Cole 1995b). Numerous studies have confirmed that people on foot can cause a variety of disturbance reactions in waterfowl and waterbirds, 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). McNeil et al. (1992) found that many waterfowl species avoid disturbance by feeding at night instead of during the day.

The long-term effects of disturbance are more difficult to assess but may include altered behavior, vigor, productivity, or death of individuals; altered population abundance, distribution, or demographics; and altered community species composition and interactions.

Knight and Cole (1991) found that wildlife responses to human disturbance include avoidance, habituation, and attraction. The magnitude of wildlife avoidance response may depend on a number of factors including the type (e.g., photographers, birders, hikers), distance, movement pattern, predictability, speed, frequency, visibility, and duration of the disturbance, as well as the time of day, time of year, weather; the animal’s access to food and cover, energy demands, and reproductive status (Gabrielsen and Smith 1995; Knight and Cole 1991). For example, Burger (1986) found that shorebird reactions to disturbance increased (fewer remained, more flew) the more they were disturbed, the larger the group size, and the closer they came to the flock. Knight and Cole (1991) also suggested that sound may elicit a much milder response from wildlife if animals are visually buffered from the disturbance.

Variables that typically have the greatest influence on wildlife behavior are the distance and duration of the disturbance. Several 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. 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 [m]) generally did not result in a behavioral response (DeLong 2002). Stolen (2003) found that the proximity of wading birds to a roadway influenced the probability that a given bird would flush. Migratory waterfowl at J.N. "Ding" Darling NWR remained more than 80 m (262 feet) from the auto tour route, even when human visitation was low (Klein 1995). Burger and Gochfeld (1991) found that sanderlings foraged less during the day and more during the night as the number of people within 100 m (328 feet) increased. Erwin (1989) found that mixed colonies of common terns and black skimmers responded at the greatest distances, with respective means of 142 m (466 feet) and to 130 m (427 feet); while mixed wading bird species were more reluctant to flush (30-50 m [98-164 feet] average). Klein (1989) found that resident waterbirds 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 m (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, while shorebirds showed moderate sensitivity. Strauss (1990) found that piping plover chicks spent significantly less time feeding and more time running and standing alert when pedestrians or moving vehicles were closer than 100 m (328 feet) than when they were undisturbed. In addition the plover chicks spent less time in open feeding areas and more time in cover during periods of human disturbance.

Burger (1999 as cited by Oberbillig 2001) suggests that viewing distances that minimize disturbance can serve as useful guides for managers lacking good site-specific information and serve as a starting point in determining what is appropriate elsewhere. Some factors that affect viewing distances include the numbers of viewers, the time of day, and noise level. When exposing nonbreeding waterbirds to four types of human disturbances (walking, all-terrain vehicle, automobile, and boat), Rodgers and Smith (1997) concluded that a buffer zone of 100 m (328 feet) would minimize disturbance to most species of waterbirds. Vos et al. (1985) recommended buffer zones of 250 m (820 feet) on land and 150 m (492 feet) in water for great blue herons.

Habituation is defined as a form of learning in which individuals stop responding to stimuli that carry no reinforcing consequences for the individuals that are exposed to them (Alcock 1993). A key factor in predicting how wildlife would respond to disturbance is its predictability. Often, when a use is predictable, following a trail or boardwalk or at a viewing deck, wildlife will accept human presence (Oberbillig 2001). Conversely, a number of species show greater reactions when pedestrian use occurs off trail (Miller et al. 1998; Taylor and Knight 2003). Gabrielsen and Smith (1995) suggest that most animals seem to have a greater defense response to humans moving unpredictably in the terrain than to humans following a distinct path. In areas where human activity is common, birds tolerated closer approaches than in areas receiving less activity. Dwyer and Tanner (1992) noted that nesting sandhill cranes in Florida habituated best to disturbance that is somewhat predictable or background. Cranes nested within 400 m (1,312 feet) of highways, railroads, and mines; and were also tolerant of helicopter flyovers. Even so, investigator visits to nests (which were presumably less predictable) and development-induced alterations of surface water drainage were implicated in 24 percent of the nest failures.

In all alternatives use of the auto tour route, service and hunter access roads, trails, and associated facilities provides potential avenues for human disturbance of wildlife and habitat on the Refuge. Impacts from non-consumptive uses can be controlled most effectively, mitigating the effect on refuge wildlife, by managing these uses in time and space. In all alternatives the Refuge would minimize disturbance to wildlife and their habitats, by only being open to the public from ½ hour before and after sunrise and sunset. To minimize disturbance during formal education programs the refuge staff would manage group size, timing, and locations in Alternatives 2 and 3. Refuge law enforcement will be used in all alternatives to ensure visitors compliance with refuge rules.

In all alternatives, vehicle, bicycle, and pedestrian access would be allowed year round on the 6.3-mile auto tour route, and bicycle and pedestrian access would allowed year-round on 27 miles of service roads. An additional 6.5 miles of hunter access roads leading to the north and south hunt units would be open to vehicle, bicycle, and pedestrian access during the waterfowl and upland game hunting seasons. The birding trail, which does not go through waterfowl habitat, would be open to pedestrian use only. The zone of influence of the auto tour route would include the edges of core wetlands, however this zone is small compared to the overall wetland area. The effects of the tour route to waterfowl use and production on these wetlands would be minor, while providing the public with good opportunities to participate in wildlife observation and photography. The service roads and hunter access roads primarily go through upland habitat. In Alternative 3, the 7.5 mile Sandhole Lake service road would be opened to vehicle traffic seasonally (July 1-Nov 1). This could result in moderate negative impacts to waterfowl that use the Sandhole Lake area during the breeding and fall migration seasons.

Alternative 1 (Current Management) has the greatest potential for wildlife disturbance, since the entire 10,806-acre Refuge open to off-road hiking from July 15-February 28. While this is outside the breeding or nesting season for most wetland wildlife, there is the potential for disturbance to waterfowl and waterbirds with long brood rearing periods (e.g. swans, some colonial nesting birds) or staging sandhill cranes. To reduce disturbance, Alternative 3 would restrict off-road hiking to 2,510 acres (the north and south waterfowl hunting units), while Alternative 2 would prohibit off-road hiking, except by hunters in pursuit of game during the hunt seasons. By increasing predictability of human presence and restricting (Alt 3) or eliminating (Alt 2) off-trail travel, both Alternatives 2 and 3 would result in lower levels of disturbance to waterfowl and waterbirds than Alternative 1.

The Refuge is currently very popular with wildlife photographers, with an average of 600 visits per year and 1,000 visits for the purpose of photography in 2012. Wildlife photography is likely more disturbing, per instance, than wildlife observation because photographers tend to approach animals more closely (Klein 1993; Morton 1995). Klein (1993) observed at Ding Darling NWR, that of all the non-consumptive uses, photographers were the most likely to attempt close contact with birds, and that even a slow approach disrupted waterbirds. Under Alternatives 2 and 3 we would allow the use of up to five portable photography blinds within 100 feet of roads at any given time (Alternatives 2 and 3). While this could result in minor short-term disturbance to wildlife in the vicinity of the blinds, overall impacts would be lower than Alternative 1 which would allow off road hiking throughout the Refuge from July 15-February 28. Use of blinds would able be less disturbing to wildlife than photographers on foot leaving established roads and trails.

Dogs elicit a greater response from wildlife than pedestrians alone (Hoopes 1993; MacArthur et al. 1982). In the case of birds, the presence of dogs may flush incubating birds from nests (Yalden and Yalden 1990), disrupt breeding displays (Baydack 1986), disrupt foraging activity in shorebirds (Hoopes 1993), and disturb roosting activity in ducks (Keller 1991). Despite thousands of years of domestication, dogs still retain instincts to hunt and chase. Given the appropriate stimulus, those instincts can be triggered. Dogs that are unleashed or not under the control of their owners may disturb or potentially threaten the lives of some wildlife. In effect, off-leash dogs increase the radius of human recreational influence or disturbance beyond what it would be in the absence of a dog. Both the Preferred Alternative (2) and Alternative 3 would require persons hiking or walking with dogs to maintain control of their animal while on the Refuge by use of a short leash or electronic collar, thereby reducing the potential and severity of these impacts to wildlife. In Alternatives 2 and 3, dog-walking would be restricted to the Auto Tour Route and designated service roads, and would be prohibited on the 1.3 mile birding trail, further reducing the potential for disturbance to waterfowl and waterbirds.

Overall, Alternatives 2 and 3 would result in slight negative impacts to waterfowl and waterbirds; however impacts would be lower than in Alternative 1 due to the elimination (Alt 2) or reduction (Alt 3) in off road hiking, which could take visitors into sensitive resource areas. The Preferred Alternative (Alternative 2) would focus public use to occur within manageable areas and reduce the potential for human activities to disturb wildlife.

6.3.3 Effects to Waterfowl and Waterbirds from Hunting

Effects from Waterfowl Hunting

In all alternatives waterfowl hunting would occur on 2,510 acres of Camas NWR. The Refuge has a history of providing quality waterfowl and upland game hunting opportunities. In the 1950s and 1960s, when plentiful water resources allowed the Refuge to keep ponds flooded well into the fall, local hunters viewed the Refuge among best the waterfowling in the area. Over the past 20 years, due to the declining water table in the area, waterfowl hunting opportunities on the Refuge have declined, to the point where they are almost non-existent today. Even though proposed changes in water management within Alternative 2 (Preferred Alternative) and Alternative 3 may increase the productivity of wetlands on the Refuge, it is unlikely if these changes would allow wetlands to hold water late enough in the season to improve water hunting opportunities compared to current conditions.

Belanger and Bedard (1995) concluded that disturbance caused by hunting can modify the distribution and use of various habitats by birds (Madsen 1985; Owens 1977; White-Robinson, 1982). In Denmark, Madsen (1995) tested disturbance effects of hunting by the establishment of two experimental reserves where hunting activity was manipulated such that sanctuary areas were created in different parts of the study area in different hunting seasons. In both reserves, waterbird numbers increased most strongly in hunted species (threefold to fortyfold), with highest densities found in sanctuary areas, irrespective of where these sanctuaries were sited. At Sacramento National Wildlife Refuge, in California, researchers found statistically significant differences in the densities of northern pintails among hunting units, units adjacent to hunting units, units adjacent to auto tour route, and units isolated from disturbance (Wolder 1993). Prior to the opening of hunting season, pintail used units in proportion to their availability, indicating no preference to particular areas. During the hunting season, 50-60 percent of the pintails on the Refuge were located on the isolated units that contained 26-28 percent of the refuge wetlands, suggesting a strong waterfowl preference for areas of little human activity. Units along the auto tour route and adjacent to hunting units maintained pintails at similar proportions to their availability. Three to sixteen percent of the pintails on the Refuge were located on hunted units (36-40 percent of the available habitat) during non-hunt days (four days per week) and almost entirely absent on days when hunting was taking place, indicating an avoidance of the hunted areas.

Belanger and Bedard (1989) studied the effect of disturbances to staging greater snow geese in a Quebec bird sanctuary over 471 hours of observation. They found that the level of disturbance (defined as any event causing all or part of the goose flock to take flight) that prevailed on a given day in fall influenced goose use of the sanctuary on the following day. When disturbance exceeded two events per hour, it produced a 50 percent drop in the mean number of geese present in the sanctuary the next day.

Waterfowl hunting as proposed in all alternatives would have a negligible effect on local, regional, or Pacific Flyway waterfowl populations because the number of waterfowl taken on the Refuge represents only a tiny fraction of the total estimated harvest. In addition, overall populations would continue to be monitored and future harvests would be adjusted as needed under the existing flyway and State regulatory processes. As discussed in the Compatibility Determination (Appendix B), although disturbance to wintering waterfowl would occur during the hunting period, this disturbance would be minimal because of the small area available for hunting and the short time frame of the hunt before freezing conditions cause waterfowl to leave the Refuge and continue migrating south. National waterfowl experts who have looked at the cumulative impact of disturbance stemming from hunting on national wildlife refuges (U.S. DOI 2009) concluded that hunting disturbance has less impact than the direct mortality caused by hunting. Further, since the direct impacts of hunting cannot be clearly demonstrated to be detrimental at most population levels, then disturbance has not been demonstrated to result in any population level effects on waterfowl (U.S. DOI 2009).

National Environmental Policy Act (NEPA) considerations by the U.S. Fish and Wildlife Service (Service; 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 (EPA) on June 9, 1988. A Notice of Availability was published in the Federal Register on June 16, 1988 (53 FR 22582), and a Record of Decisions (ROD) was signed on August 18, 1988 (53 FR 31341). Current year NEPA considerations for waterfowl hunting frameworks are covered under a separate Environmental Assessment—Duck Hunting Regulations for 2006-2007, and an August 24, 2006, Finding of No Significant Impact (FONSI). Further, in a notice published in the September 8, 2005, Federal Register (70 FR 53376); the Service announced its intent to develop a new supplemental environmental impact statement for the migratory bird hunting program. Public scoping meetings were held in the spring of 2006, as announced in a March 9, 2006, Federal Register notice (71 FR 12216).

The waterfowl harvest in Idaho is presented in Table 6.2, below. This includes waterfowl harvested on other national wildlife refuges, other public lands and waters, and private lands. Table 6.2 details the current harvest rates and populations (where available) or population trends at various levels for ducks, geese, and other migratory birds. Wintering populations are not accurately measurable for migratory birds at small scales such as at the Refuge or refuge management unit level. This is because birds can easily move from one site to another and even make long distance journeys from day to day while the survey is underway. Regional and local population surveys are best understood as an “index” (best used to measure trends over time) and not a true census at any particular time.

Waterfowl hunting would occur under all three alternatives. Total harvest could be similar in all alternatives. In comparison with statewide harvests, the harvest of migratory birds on the Refuge is minimal. Although refuge hunt statistics are not available, the low number of annual hunt visits means that only a few dozen birds may be harvested annually, even assuming that all waterfowl hunters reach their bag limits. Therefore, the Refuge’s role in the cumulative impact of migratory bird harvest, even solely on a statewide basis, is insignificant.

Table 6.2. Waterfowl Harvest and Population at Flyway and State Levels

Area	Total Harvest—2008/2009	Total harvest—2009/2010	Area Population
Duck			
Pacific Flyway Total	3,300,600±10%	2,781,900±12%	Mid-winter survey (Pacific Flyway): 5,356,550 (2008); 5,235,386 (2009); 5,679,473 (long-term average 1955-2009)
State of Idaho	257,700±22%	228,300±22%	Mid-winter survey: 21,894 ducks in area 33-1N (North Idaho) (2009)
Goose			
Pacific Flyway Total	555,100±22%	430,700±10%	Mid-winter survey: 1,777,400 (2009); 1,000,652 (long-term average 1955-2009)
State of Idaho	64,500±25%	58,300±25%	Mid-winter survey: 7,824 geese in area 33-1N (north Idaho) (2009)

Effects to Waterfowl and Waterbirds from Elk Hunting

Alternative 1 would not open the Refuge to elk hunting. Proposed elk hunts in Alternative 2 (Preferred Alternative) and Alternative 3 would open 4,112 acres of the Refuge to elk hunting and could cause some degree of disturbance to migratory birds in the fall on the south 1,530 acre waterfowl hunt unit, as well as the Rays Lake area, which is outside the waterfowl hunt unit but within the proposed elk hunt area.

The amount and degree of disturbance to waterfowl would depend on the condition of the refuge wetlands, in particular Rays Lake and Sandhole Lake. If late season water is present in Rays Lake, waterfowl, mostly Canada geese, will use the lake for roosting during the elk season. As fall approaches Canada geese tend to congregate in larger flocks and will look for larger bodies of water to roost upon. Both Rays Lake and Sandhole Lake can hold large numbers of geese in fall; Rays Lake is located within the proposed elk hunting area. Typically these geese leave the Refuge shortly after first light to feed and may return to rest and drink about mid-morning. They will typically leave again in late afternoon to feed, and return at dark daily.

Periodic shooting, or hunters walking in close proximity to these wetlands, could temporarily disperse birds. This disturbance would be limited in scope by the low number of elk hunters at any given time (maximum of two daily) and over the entire season (a maximum of 20 refuge access permits for elk hunting would be issued per season). The rate of gunfire discharge is expected to be infrequent and random based upon opportunistic individual shots at elk in range. The frequency of gunfire may be only a few shots per day at most, causing temporary and short-term disturbance to waterfowl.

Disturbance of trumpeter swans with broods is a potential concern during the early portion of the elk hunting season. The young of trumpeter swans typically hatch in late June, however nesting, laying, hatching, and fledging dates of trumpeter swans vary widely even within areas, due to annual weather patterns. For example, Gale et al. (1987) give first hatching dates at Red Rock Lakes NWR, MT between May 30 and July 1 in different years, while within-year hatching dates varying by one to three, and exceptionally six, weeks. In typical years swans would be fledged by mid-October, but in years with late nesting, swans with cygnets could be present as late as November 1, although this is unlikely given the lack of late season water in the areas of the Refuge used by swans for brood rearing. While the proposed elk hunt could disturb trumpeter swans and their broods during the early portion of the hunting season, disturbance of swans by elk hunters is unlikely due to the fact that the hunt area, and the area where elk spend the bulk of their time, lies outside the area where swan nesting and brood rearing have historically occurred.

There is little information about the effects of human activities to swans on wintering or migratory staging grounds. However, those human activities that disturb swans on breeding grounds likely affect swan behavior on wintering or migratory staging grounds. Disturbances to swans that disrupt winter or migratory foraging activities or cause frequent movements from resting areas may decrease overall condition or even cause mortality (Mitchell 1994). Swans in poorer condition during migration or on the wintering grounds may have higher mortality during a severe winter event or epizootic outbreaks (Anderson et al. 1986). In a particularly wet year, pedestrian access from elk hunters could disturb some foraging swans in the Rays Lake area. However, there is seldom enough water in Rays Lake in an average or dry year to be attractive to swans, and swans collectively spend little time in the 4,112 acre elk hunting area. There is no documentation of swans nesting or rearing broods in the proposed elk hunt area. Furthermore, during the required pre-hunt orientation hunters would be advised of the current locations of swans. Elk hunters must maintain at least a 400 meter (¼ mile) distance from wetlands where swans are rearing their broods. As noted above, the framework of the refuge hunt allows the Refuge to selectively close areas, as detected, to protect sensitive wildlife resources within the hunt area with spatial buffers. Due to these stipulations, impacts to swans would be negligible.

The controlled elk hunt has the potential to disturb greater sandhill cranes, which use Rays Lake (within the proposed elk hunting area) and to a lesser degree, Sandhole Lake (which lies outside the proposed elk hunting area) as roost sites during pre-migration staging. Sandhill cranes present at Camas NWR are from the Rocky Mountain population, which stage in specific locations throughout their summer range during late August to early October. In typical years, crane numbers at Camas NWR peak in mid-September and the majority of cranes have left the Refuge by early October. However, during open winters (no snow), low numbers of cranes have been observed on the Refuge into December. Staging cranes can be found on various types of habitat on the Refuge including dry upland sites, hayed areas, and agricultural fields. In September, large numbers of cranes roost on Rays Lake; lower numbers may use Sandhole Lake. Typically, cranes prefer Rays Lake for roosting due to its shallower water. Cranes typically leave the Refuge twice a day (early morning and again in the evening) to forage in grain fields in the local area and return to the Refuge to roost. A smaller number feed in agricultural fields located on Refuge (refuge grain fields are located outside the hunt area). The existing migratory and upland game bird hunting programs have minimal impacts to sandhill cranes due to the low numbers of hunters pursuing these species, and the fact that Rays Lake and Sandhole Lake lie outside the north and south hunt units.

Sandhill cranes have shown susceptibility to even low levels of disturbance at roost sites (Bettinger and Milner 2000; Littlefield and Ivey 2000). Observations of numerous roosting sites by Lewis

(1976) and Lovvorn and Kirkpatrick (1981) indicated that roosts were characterized by level terrain, shallow water bordered by a shoreline either devoid of vegetation or sparsely vegetated, and an isolated location that reduces potential for disturbance by humans. Pedestrian and vehicle traffic can potentially disturb breeding and roosting cranes (Engler 2000; Kramer et al. 1983; Norling et al. 1992). Bettinger and Milner (2000) recommend that “Hunting activity should be avoided near established roosts, or restricted to 4 hours after sunrise until 2 hours before sunset.”

Because of the sensitivity of roosting cranes to disturbance, elk hunters would be advised of the location of sandhill cranes during their pre-hunt orientation. Hunters must maintain a distance of at least 400 m (¼ mile) of roosting cranes while in pursuit of elk. The framework of the refuge hunt also allows the Refuge to selectively close areas, as detected, to protect sensitive wildlife resources within the hunt area with spatial buffers. Resource buffers would be used to sufficiently safeguard sandhill crane roost sites from abandonment. Due to the stipulations associated with the elk hunt, impacts to sandhill cranes would be expected to be minor.

6.3.4 Overall Effects to Waterfowl and Waterbird Species

Changes to habitat management in Alternatives 2 and 3 would not cause any significant adverse effects to local, regional, or flyway waterfowl populations. Changes in the type of habitat (a lower quantity but higher quality of deepwater and hemi-marsh habitat, and greater quantity and quality of shallow seasonal wetland habitat and wet meadows) would occur under Alternative 2 (Preferred Alternative) and Alternative 3. The reduction of deepwater wetlands in Alternatives 2 and 3 may cause a minor decline in local waterfowl production; however it is also possible that minor to moderate increases in production may occur due to increased quality and productivity of both deepwater and seasonal wetland habitats. Proposed management in the Preferred Alternative and Alternative 3 would provide moderate positive beneficial effects to migratory waterbirds through increased seasonal wetland availability, when compared to Alternative 1. Supplemental crops would be provided in all alternatives. The amount of grain would be the same under all alternatives; however changes to mowing practices in Alternatives 2 and 3 would increase availability of grain to migrating birds late in the season. Reductions in irrigation of hay meadows would likely reduce quality and quantity of forage available to select wildlife species; however this only affects a small area (150 acres in Alt 2 and 330 acres in Alt 3) and would likely be more than counterbalanced by increases in seasonal and moist-soil wetlands under these alternatives.

With the continuation of existing public use activities and facilities under Alternative 1, a projected increase in refuge visitation is expected to have a minor negative impact on waterfowl usage of refuge habitats in the future. Effects of nonconsumptive public uses to waterfowl and waterbirds would be lower in Alternative 2 (Preferred Alternative) than Alternative 1 (Current Management) or Alternative 3, due to the prohibition of off road hiking and limitation on placement of photo blinds to a maximum of five at any given time, within 100 feet of roads. The impacts of continuing the recreational waterfowl hunting program under all alternatives would be negligible. Overall waterfowl harvest levels on the Refuge represent a very small portion of the State and flyway harvest and are not expected to increase or decrease significantly under any alternative. Waterfowl harvest on the Refuge also accounts for a very small portion of the overall waterfowl production and the number of birds available to hunt at both the flyway and State levels. The elk hunt proposed in Alternatives 2 and 3 has the potential to disturb migrating Canada geese, late-nesting swans, and staging sandhill cranes; however, due to the stipulations associated with the elk hunt, impacts to these species would be expected to be minor.

6.4 Effects to Threatened and Endangered Species

The Endangered Species Act (ESA) (16 U.S.C. §§ 1531-1544, December 28, 1973, as amended 1976-1982, 1984, and 1988) states in SEC. 8A.(a) that "The Secretary of the Interior … is designated as the Management Authority and the Scientific Authority for purposes of the Convention and the respective functions of each such Authority shall be carried out through the United States Fish and Wildlife Service." The Act also requires that "all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act."

The following federally listed or Federal candidate species are considered to occur within the surrounding landscape of the Refuge:

Threatened

a. <u>Ute ladies'-tresses (*Spiranthes diluvialis*)</u>

   Camas NWR is within the historic range for Ute ladies'-tresses. The plant grows along riparian edges, gravel bars, old oxbows, high flow channels and moist to wet meadows along perennial streams. It typically occurs in stable wetland and seep areas associated with old landscape features within historical floodplains of major rivers (USFWS 2010). There is no known occurrence of Ute ladies'-tresses on the Refuge and no effect to Ute ladies' tresses would occur from proposed refuge activities in this CCP.

b. <u>Canada lynx (*Lynx canadensis*)</u>

   Camas NWR is within the historic range for Canada lynx. The lynx is a secretive forest dwelling cat historically found throughout much of Canada, the forests of northern tier states, and subalpine forest of the central and southern Rocky Mountains. There have been known occupancies in Jefferson County, but the refuge wetlands and sage-steppe habitats are not lynx habitat and there are no documented records of lynx on the Refuge (Laye 2012). No direct or indirect effect to Canada lynx would occur through implementation of this CCP.

Due to the lack of presence of any listed species on the Refuge, there would be no effects to listed species under all alternatives.

Candidate

a. <u>Yellow-billed cuckoo (*Coccyzus americanus*)</u>

   Camas NWR is within the historic summer and breeding range for yellow-billed cuckoos. The birds prefer open woodlands with clearings and dense scrubby vegetation, often along water (Cornell University 2011). Yellow-billed cuckoos have been documented on Camas NWR in the spring and summer. It is listed as rare (known to be present but not every year) for the Refuge. Riparian habitat management strategies in the Preferred Alternative (Alternative 2) would provide a positive beneficial improvement in habitat quality for yellow-billed cuckoo. Although the birds may be present during periods of public summer visitation and during the fall hunting season, disturbance from these activities would be minimal.

b. Greater sage-grouse (*Centrocercus urophasianus*)

Camas NWR is within the historic range for sage grouse and offers about 4,000 acres of preferred shrub-steppe habitat. Sage-grouse have been observed during all seasons and are known to nest on the Refuge. The greatest positive benefits to sage-grouse and would occur through Alternative 3, which places an equal emphasis upon upland and wetland habitat objectives and would actively seek to restore landscape connectivity within sagebrush ecosystems to support and maintain integrated sage-steppe wildlife communities. Although sage-grouse are present during the summer and fall, interaction with visiting public and hunters would be minimal in all alternatives. With the limited number of access permits given for the elk hunt and the low density of upland game bird hunters, the negative impacts on greater sage-grouse from either elk hunting or upland game bird hunting should be minimal.

Effects to Sage-grouse from Upland Game Bird Hunting Program

On March 5, 2010 the USFWS announced its determination that a range-wide listing of the greater sage-grouse as threatened or endangered under the Endangered Species Act of 1973 was warranted, but precluded by higher priority listing actions (USFWS 2010). Therefore, sage-grouse are a “candidate” species under the Endangered Species Act, but remain a State-managed species. In light of this decision, concerns have been expressed about the potential impacts that hunting greater sage-grouse may have on their long-term conservation and annual status reviews conducted by the USFWS. Harvest of greater sage-grouse currently occurs in nine of the eleven states in which they reside, including Idaho. All of Southeast Idaho, including all portions (open to hunting) of the Refuge in Jefferson County, was open to a conservative seven-day hunt from October 1-7, 2011. Just over 4,000 birds were harvested statewide in 2011.

Under all alternatives, upland game bird hunting would continue to be allowed on 2,510 acres of the Refuge. Upland game bird hunting is expected to remain a low intensity use in all alternatives. The March 2010 listing decision (USFWS 2010) supports continued hunting in Alternative 1, by concluding that the key threats to the continued survival of sage-grouse are 1) habitat loss, fragmentation, and modification and 2) inadequacy of existing regulatory mechanisms, particularly in relation to energy and other development. The USFWS also evaluated the “utilization” (e.g., hunting) of sage-grouse and concluded that “the greater sage-grouse is not threatened by overutilization for commercial, recreational, scientific, or educational purposes now or in the foreseeable future”. This finding was similar to a January 2005 finding whereby the USFWS determined that hunting, as currently regulated by state wildlife agencies, was not a significant threat to the conservation of sage-grouse. The expert panel used by the USFWS to make this determination ranked hunting seventeenth out of nineteen potential threats considered (USFWS 2005).

Conversely, the Center for Biological Diversity (CBC), who petitioned the sage-grouse for listing in 2009, while acknowledging that hunting is not a major contributor to the causes of the grouse’s decline, still recommends hunting season closures to reduce all controllable risks to the species to maximize its chances for recovery. Others, such as the American Land Alliance (ALA), which petitioned the bird for ESA listing in 2003, states that due to allee effects, sage-grouse population size decreases are unlikely to be linear and easily detectable. The term allee effect refers to the negative effects on population processes of low population size or density (Allee 1938, 1951; Drickamer and Vessey 1992). The ALA contends that as localized sage-grouse population size decreases to some threshold value, rapid sage-grouse declines and extirpation are likely. Such declines may be so rapid as to be undetectable before they actually occur, or if detected, extirpation may not be preventable by that point. ALA argued that hunting of sage grouse can greatly increase local extinction risk, and this risk will not be accounted for in conventional models of population harvest (ALA 2003).

Many states subsequently implemented cautionary hunting seasons (Christiansen 2010) in line with recommendations outlined in the sage-grouse management guidelines (Connelly et al. 2000). The Idaho season is now only seven days in length, occurs outside the breeding season in late fall, and has a bag limit of one bird per day and possession limit of two birds. Wyoming, Nevada, and Idaho contend that sage-grouse hunting regulations take into account biology, formal public involvement via state and local planning efforts, and informal public perceptions, and that the consequences of deviating from established management guidelines and conservation plans could undermine local sage-grouse conservation efforts (Christiansen 2010). Wyoming Fish and Game (2010) further concluded that closing hunting seasons where biological data do not justify such a management decision would create a public perception that sage-grouse populations in Wyoming may indeed require protection under the Endangered Species Act and that by recognizing unfounded concerns about hunting impacts, hunting closures would threaten voluntary conservation initiatives.

The Refuge does not believe that the associated reduction in sage-grouse harvest from eliminating refuge hunts would have even a minor positive benefit to the local grouse population. Although sage-grouse hunting is currently open to hunting on the Refuge, eliminating this hunt would have a negligible effect on local hunting opportunities because bird densities are low, the hunting season established by IDFG in this area is brief (usually one week), and there is very little local hunter interest in this species. Therefore, sage grouse hunting would continue to be allowed in all alternatives but would be expected to have a negligible impact on the local grouse population.

6.5 Effects to Wetland Habitats and Associated Species

Differences between alternatives in effects to wetland habitat and associated wildlife are the result of changes in the quantity and quality of wetlands through changes in the management of water and wetland vegetation, riparian management and rehabilitation, fire management, control of invasive species, and management of public uses (hunting, wildlife observation and photography, and environmental education and interpretation).

Wetland habitats are composed of five distinct habitat types at Camas NWR: Open water, Hemi-marsh (open water, submerged aquatic, and deep emergent); shallow marsh (which includes shallow seasonally flooded wetlands or “moist soil” units, seasonal to semipermanent emergent wetlands, and palustrine scrub-shrub wetland); wet meadow; and riparian (in-stream and willow riparian habitat).

Continuation of current management (Alternative 1) would provide approximately 736 acres of open water (primarily Sandhole Lake), 840 acres of hemi-marsh habitat, 1,213 acres of shallow marsh habitat, 40-60 acres of moist soil wetlands, 239-259 acres of willow scrub-shrub wetlands, 1,958 acres of wet meadow habitat (with an additional 60-70 acres targeted for restoration), 20-40 acres of willow riparian habitat associated with Camas Creek, and would maintain four miles of riparian in-stream habitats. Alternative 2 (Preferred Alternative) and Alternative 3 would provide more diverse and variable refuge wetlands: approximately 285 acres (range 250-300 acres) of hemi-marsh habitat, 1,743-1,803 acres of shallow marsh, 150-200 acres of moist soil wetlands, 2,178-2,258 acres of wet meadows (maintain 1,958 acres and restore 220-300 acres), 100-150 acres of willow riparian habitat associated with Camas Creek, and would maintain and restore 8 miles of in-stream riparian habitats. Acres of open water would remain the same as in Alternative 1.

The action alternatives (Alternatives 2 and 3) would therefore decrease the extent of deep hemi-marsh habitat in the next four years (2014-2017), but increase the extent of the shallow marsh, wet meadow, willow riparian, and in-stream habitat. In Alternatives 2 and 3, wetland management practices from 2014-2017 would cause a sizable 530-590 acre decrease in hemi-marsh habitat (64-70 percent decrease), a sizable 530-590 acre increase in shallow wetlands (44-49 percent increase), a sizable 110-160 acre increase (250-500 percent increase) in seasonally flooded shallow marsh (moist soil), a moderate 150-240 acre increase (314-500 percent increase) in the acres of wet meadow habitat restored over the lifetime of the CCP, a minor increase in total wet meadow habitat (11-15 percent), a sizable 80-110 acre increase (400-650 percent increase) in willow riparian habitat associated with Camas Creek, and a 4 mile increase (100 percent increase) in riparian in-stream habitat. Acres of willow scrub-shrub wetlands and open water habitat would remain unchanged from current management.

6.5.1 Effects to Wetland Habitats and Wildlife from Habitat Actions

Wetland Management

For most of the 20th century, between about 1915 and 1980, Camas National Wildlife Refuge was composed of a diverse mosaic of shallow seasonal and semipermanent wetland and wet meadow habitats, surrounded by an expansive sea of sagebrush. The wetlands and wet meadows were fed surface water via overbank flooding of Camas Creek, while artesian wells discharged perched groundwater, continually flooding the wetlands through the drier summer and fall months. Prior to 1915, artesian discharge was confined to Sandhole Lake area. Discharge increased in the early 1900s due to subirrigation of the Egin Bench, 15 miles to the east. Although Regional surface water hydrology has been highly altered from historic conditions, and groundwater levels have dropped since 1980, when subirrigation of the Egin Bench ceased, providing a diversity of wetlands is still vital to the Refuge’s purpose of providing safe haven for a variety of breeding and migrating waterbirds.

The Refuge is now faced with management limitations associated with water availability due to the lowering of the water table in the Eastern Snake River aquifer over the past 30 years. The cumulative effects of agricultural irrigation diversion and groundwater pumping have combined to impact groundwater discharge wetlands within the Camas and Beaver watersheds (IDEQ 2005), and many wetlands have been placed in inactive status due to their inability to hold water.

Today the quantity and quality of wetland habitats at Camas NWR are determined by how the Refuge uses surface and groundwater rights and its water delivery infrastructure to manage water levels within a series of wetland impoundments. In Alternative 1, the Refuge would continue to work within the constraints of its current wetland infrastructure, which dates to the 1960s. This water control infrastructure was designed to provide deep marsh habitat to support waterfowl production in a time of abundant surface and groundwater supplies. The construction of dikes and water control structures at Camas NWR allowed for improved hydrology and wetland function through precise manipulation of water levels. At the time of Refuge establishment, Camas NWR wetlands were flooded by artesian groundwater discharges. Currently, due to the lowered water table, groundwater pumping is necessary to maintain wetlands through the summer. In Alternative 1, the main refuge point of diversion from Camas Creek remains in its original location, with only one groundwater well being moved since the original drilling of the seven irrigation wells. From this main diversion point on Camas Creek, water must flow two miles in order to reach the first managed wetland basin. The prescriptive management conditions of Alternative 1, to provide consistent deepwater wetlands, has led to relatively static and unproductive conditions in those deepwater wetlands that can be maintained.

Alternatives 2 and 3 would simulate historic hydrologic processes within the Camas Creek floodplain, while retaining adequate wetland acreage for the wetland-dependent species. Wetlands would be managed within six impounded basins that have tighter pockets of natural hydric soils (Big, Redhead, Toomey, Spring, Center and Two-way Ponds). However, only three to four of these basins would be managed for hemi-marsh habitat. Under this approach, wetlands would be anticipated to hold water longer, making more efficient use of refuge resources and water. Further efficiencies in water use would be realized by moving the main point of diversion and irrigation wells downstream closer to the wetlands, which would reduce water losses through evapotranspiration and groundwater seepage.

The reduced productivity caused by static water regimes in Alternative 1 would be remedied in Alternatives 2 and 3. In these alternatives, water levels would be managed to meet seasonal life history requirements of focal species, but wetlands would also be managed dynamically to maintain and enhance their productivity over time. We would use flooding, drawdown, prescribed fire, and disturbance (e.g. disking), in rotation among different management units to create desirable hemi-marsh conditions, while still maintaining essentially the same acreage from year to year. Periodic drying or drawdown cycles would mimic natural variability and regulate vegetation growth, preventing wetlands from becoming dominated by dense stands of emergent vegetation. Disking would only be performed when needed to control reed canarygrass and improve wetland plant diversity by opening up dense stands of cattail and bulrush. The Refuge would reduce impacts of management by delaying disking and mowing operations until after most wetland bird species have completed nesting (approximately August 1). Due to these management changes, foraging resources (submerged aquatic vegetation, invertebrates) are expected to dramatically increase. Degraded and unproductive expanses of open water habitat would decrease, while submerged aquatic foraging habitat would increase.

In comparison to Alternative 1, Alternatives 2 and 3 would provide decreased deep emergent breeding waterfowl habitat, but increased seasonal shallow wetlands and wet meadows for migratory waterbird breeding and foraging habitats. In Alternatives 2 and 3, shallow wetlands would increase by 44-49 percent, and shallow seasonally flooded (moist soil) wetlands would increase by 250-500 percent. As noted in Section 6.2.1 above, these habitats are highly productive for waterfowl, and abundance and productivity of dabbling ducks and waterbirds that forage in these habitats would be expected to increase.

In Alternatives 2 and 3, approximately 80-100 acres of selected fields containing cool-season non-native grass monocultures would be rehabilitated to wet meadow habitat over the lifetime of the CCP. Management strategies, including wetland flooding and water schedule adjustments, the designation of alternative suitable acres to meet irrigation prescriptions, cool-season grass treatments, disking, mowing, chemical applications, and/or prescribed fire would reduce non-native cover and increase native grass and forb species.

In Alternatives 2 and 3, an integrated Wetland and Riparian Rehabilitation Plan (WRRP) and associated NEPA document would be developed by 2017 to guide long term habitat restoration and management (see Section 6.6.1 below). In comparison to Alternative 1's prescriptive management, the WRRP would attempt to mimic natural variability in hydrologic processes, while simultaneously conserving groundwater resources and rehabilitating partial riparian habitat function. An engineering feasibility study, using the results of HGM modeling (scheduled for completion in the next two years) would be used to determine the best engineering solution to achieve this goal. Using the results of these studies, the Preferred Alternative (Alternative 2) would remove, modify, or relocate wetland infrastructure (e.g., dikes, levees, ditches) to restore, where possible, the partial historic extent of some shallow marsh and wet meadow habitats. New diversion structures and additional points of diversion would be constructed to increase the efficacy of water delivery. This infrastructure would only partially deflect Camas Creek flows into managed wetland areas, while simultaneously allowing partial flow to remain in the Camas Creek channel. As in Alternative 1, groundwater pumping would still be used in the Preferred Alternative (Alternative 2) to compensate for losses of surface water to groundwater seepage. However, supplemental pumping efforts would attempt to mimic shallower historical artesian wetlands, rather than an expansive deep hemi-marsh.

In the interim period from 2014-2017, active management of former wet meadow sites would be used to improve the ecological condition of these sites and to prevent them from transitioning into dry or shrub meadows with weedy species invasions or undesirable species compositions (Wright and Chambers 2002). In managing wet meadow habitat within impounded wetlands, the Refuge would take into account the hydrological gradients that can drive plant community expression, and therefore both habitat quality and availability for a number of target wildlife species. In Alternatives 2 and 3 the Refuge would establish flooding prescriptions that better accommodate the habitat needs of focal wet meadow species. The Refuge would carefully identify priority areas with successional characteristics needed by focal wet meadow species. In comparison to Alternative 1 (Current Management), the more variable management of Alternative 2 (Preferred Alternative) and Alternative 3 would maintain or enhance the integrity of wet meadow habitats in areas where historical subtle variation in topography has been compromised, where overbank flooding of Camas Creek no longer occurs, or an where an unacceptable percentage of plant assemblages is shifting toward undesirable species.

Upland Management

Under both Alternatives 1 and 2, upland management and habitat restoration would be subordinate to wetland management (Alternative 1) or wetland and riparian management and rehabilitation (Alternative 2). Under Alternative 3, upland habitat restoration and wetland/riparian rehabilitation would receive equal management emphasis. Therefore, upland habitat restoration would likely compete with wetland and riparian rehabilitation for limited resources (refuge staff time, as well as grant opportunities and partnership involvement). Such an approach would be analogous to fighting a war on two fronts (Wu et al. 2000), possibly compromising the success of either effort (Bottrill et al. 2008; Mackenzie 2008). Therefore, in comparison to Alternatives 1 and 2, upland management proposed in Alternative 3 could have minor to moderate indirect negative effects on wetlands and associated wildlife, through diversion of limited resources.

Riparian Management

Refuge wetlands are influenced by incision of Camas Creek, groundwater lowering, and vegetation degradation (invasive species and conversions to drier ecological types.) Under Alternatives 2 and 3, the Refuge would develop a Wetland and Riparian Rehabilitation Plan (WRRP) by 2017 (see Section 6.6.1 below). The WRRP would identify long term management objectives for wetland and riparian habitats, as well as the most appropriate strategies for achieving these objectives. The first two years (2014-2015) would be spent collecting necessary information (geomorphological, hydrological, and biological assessments). The Refuge's wet meadow complexes are groundwater features closely tied to the riparian surface channel systems. Therefore, the HGM assessment proposed in Alternatives 2 and 3 is of utmost importance in assessing the effect of channel incision on groundwater levels, and determining the linkage between the channel and groundwater flow systems (Chambers and Miller 2011; Currier 1989; Galatowitsch et al. 2000). Concurrently (2014-2017), the Refuge would implement and monitor rehabilitation pilot projects to gain a better understanding of system response to enhancement activities. By conducting assessments and pilot studies, the Refuge would better understand how the riparian system and adjacent wetland habitats may respond to larger scale rehabilitation efforts. Using results from the pilot projects, a comprehensive plan would be crafted by 2017, and implementation of long-term rehabilitation efforts would be conducted from 2017-2027. This tiered approach is more likely to result in sustainable long term management that makes the best use of limited water resources to meet wetland objectives.

Fire Management

The practice of prescribed burning, in upland habitats, as a restoration and management tool is widespread and the ecological processes involved are becoming more fully understood as literature and practical experience develop on the subject. However, the equally-widespread practice of burning in wetlands has remained largely unresearched, its techniques borrowed from upland prescriptions, and its effects unmonitored. Unlike the literature on fire in terrestrial upland communities, however, specific fire prescriptions, knowledge of fire behavior under different fuel loadings and environmental conditions, and the detailed consequences of differing fire frequencies, fire intensities, and fire severities in wetlands are largely unknown (Kirby et al. 1988:10).

When combined with water level control, prescribed fire is likely the most effective tool for directing widespread succession in palustrine emergent marsh habitat types. Its primary utility is in altering residual vegetation coverage in deep and shallow emergent marsh habitats, or more simply, setting back vegetative succession. Controlled burns require extensive preparation time and are typically the most expensive management actions in terms of the cost of equipment and manpower. But to effect widespread change in wetland emergent communities, prescribed fire is a capable tool to accomplish the task. Three types of burns usually occur in refuge wetlands, including residual burn, mosaic burn, and fire break/wildlife urban interface burns. Each type of burn has a specific utility and use in all wetland habitat types, except for open water and submergent habitat types. A Wildlife Urban Interface (WUI) burn is used specifically to protect off-refuge lands from a wildfire originating on a refuge and is discussed in greater detail in Section 6.7.1 (Effects to Upland Habitats and Wildlife from Habitat Actions).

Residual burns are an effective means of removing excess residual vegetation and create long-term openings in hemi-marsh habitats, but have been deemed impractical on Camas NWR in the past because of its proximity to human habitation. Deep emergent marsh habitats have a target distribution based on the amount of residual cover (standing vegetation from the previous year growth). As time goes by, without some form of physical disturbance, residual coverage percentage increases, often to a point where the existing community is nearly 100 percent residual vegetation. While habitats in this condition are used by some species, they are generally considered unsuitable when they exceed 20 percent of a given habitat type. When this occurs, residual burns (burns targeted to remove 90-100 percent of the biomass) are applied. Through this action, all the residual coverage is eliminated and new vegetation growth begins to emerge. In this way, late successional habitat is converted to early successional habitat, which typically lasts for about two years before it reenters a mid-successional phase (30-90 percent residual cover).

While mechanical disturbance techniques are longer lasting, burning covers a greater area in a shorter time. Often, mechanical disturbance will be applied following a burn to increase the successional benefits of the tool. For example, most burns at Camas NWR occur during spring while snow cover is still on the ground. During this time the root mass is so wet that it remains unharmed by fire. As such, emergent vegetation returns quite rapidly and moves toward late successional status in a period of seven to ten years. By including disking sections of the burn area, open pools can be maintained when the area is reflooded. Residual burns are most effective in deep or shallow emergent habitat types; however, they can also be used in meadow grass or agricultural habitat types. In residual burns the objective is to remove all extant vegetation and allow the community to completely regenerate. In all alternatives the Refuge would use residual burns in hemi-marsh habitat. Under current management (Alternative 1), burning of wetland occurs in spring (March 1-April 15) and fall (September 20-October 30.) Summer burns are more effective in controlling tall emergent vegetation, whereas fall or spring burns promote rejuvenation of reed canarygrass (Apfelbaum and Sams 1987), cattail (Mallik and Wein 1986), phragmites (Thompson and Shay 1985) and cordgrass (Johnson and Knapp 1995). Early spring burns (March) are generally ineffective in removing dense emergent vegetation, and may even promote vegetation growth. In Alternatives 2 and 3, we would attempt to shift toward late spring and summer burns in hemi-marsh habitat, immediately followed by floodup to prevent soil erosion, where feasible. Although prescribed burns of hemi-marsh habitat would be used more in Alternative 1 than in Alternatives 2 and 3 due to the more prescriptive nature of wetland management, adjustments in the timing of burns in Alternatives 2 and 3 would be more likely to meet habitat objectives.

In most situations and habitat types, mosaic burns are the more practical and beneficial tool to apply. Designed to remove up to 70 percent of the residual biomass, this type of burn leaves some areas of dense residual vegetation unburned which adds to the diversity of the community. Mosaic burns are most effective in wet meadow habitats where the past years accumulated growth of Baltic rush has accumulated. Topographic variation in the unit (often referred to as microtopography) often results in small depressions where water stands for extended periods of time. When these depressions are interspersed with slightly higher areas that dry more quickly, this results in differing levels of residual growth that allows the fire to carry through some patches and bypass others. The result is a mixed burn, with anywhere from 0-100 percent of the residual vegetation removed. A typical target for residual burns is to consume about 70 percent of the vegetation within the burn area; however, distribution of residual vegetation and microtopography typically controls what the final percentage will be. Below 50 percent residual coverage, it is not necessary to burn. Unlike residual burns, mosaic burns can be used in any habitat type except open water and submergent, but are most effective in wet meadow habitats. In all alternatives, we would use prescribed fire to create mosaic burns in wet meadow habitats. The burning program as described would result in moderate improvements to habitat conditions in Refuge wetlands in all alternatives.

Agricultural Crops and Haying

Alternative 1 (Current Management) would irrigate 330 acres of grassland habitat and annually harvest 150 acres (50 percent) of irrigated grasslands through cooperative farming agreements. Alternative 2 (Preferred Alternative) would reduce irrigation by 55 percent to irrigate 150 acres and harvest 150 acres of hay from refuge-irrigated grasslands annually. Alternative 3 would eliminate irrigation of refuge meadow habitats.

In assessing the positive and negative effect from irrigation and haying on the Refuge, it is important to recognize the valuable role that temporarily flooded meadows play within refuge ecosystems of larger seasonally and semipermanently flooded habitats and upland dry meadows and upland shrub habitats. Flooded meadow habitat mosaics, where proximate to both tall emergent wetland and upland habitat, create a richness of habitat biodiversity that would not occur if the habitats existed in isolation from one another. By decreasing irrigated alfalfa by 80 acres and eliminating upland hay irrigation operations on 300 acres, Alternative 3 would prioritize the use limited water resources towards achieving wetland objectives and regaining as much of the historic wetland hydrograph as possible. Alternative 3 would moderately reduce meadow and upland haying operations to maintain inundation of wetland shallow marsh and wet meadow habitat through the summer. Alternative 2 (Preferred Alternative) would still use groundwater pumping to flood irrigate hay meadows, but in comparison to Alternative 1 (Current Management), Alternative 2 would irrigate 150 less acres annually, and use less groundwater to provide irrigated short-cover habitat for focal wildlife. Alternative 2 therefore strikes a balance between water conservation and providing short-cover habitat for select wildlife species.

Invasive Species Management

In all alternatives, an integrated pest management (IPM) approach would be used, where practicable, to eradicate, control, or contain pest and invasive species (herein collectively referred to as pests) on refuge lands. IPM would involve using methods based upon effectiveness, cost, and minimal ecological disruption, which considers minimum potential effects to non-target species and the refuge environment.

For wetland weed species that are or become established, mechanical, cultural, biological, and chemical control methods would be evaluated (see Appendix F). Chemical usage would be subject to provisions of the refuge IPM plan (Appendix F). Among other provisions, this plan provides direction that “the most efficacious pesticide available with the least potential to degrade environmental quality (soils, surface water and groundwater) as well as least potential effect to native species … would be acceptable for use on the Refuge.” Each approved pesticide would undergo a chemical profile analysis; active ingredients would be analyzed for their risk quotient and this value compared to a Level of Concern for surrogate species, as established by the Environmental Protection Agency (EPA). All applications of herbicides would conform to the specific pesticide label requirements for wetland habitats to ensure that toxic levels of pesticides would not accumulate or affect wetland habitats.

Within all alternatives, use of herbicides would create a moderate to minor risk from chemical exposure. However, unquantified risks may still occur via factors not assessed under current protocols, such as intermingling of unlike chemicals in the field; species-specific sensitivity that differs from surrogate species sensitivity; exposure through inhalation, exposure through ingestion of pesticide-contaminated soil, and other factors (see Appendix F).

Wetland habitats can also be affected by invasive species being spread by moving wetland management equipment or boats from site to site. Under all alternatives, invasive species may also become established where soils and existing plant cover is disturbed. In all alternatives, refuge equipment operators are required to clean equipment before moving between sites to reduce the spread of seeds and plant parts. The Refuge would continue to monitor wetlands for invasive weeds, aggressively control invasive plants, and restore sites to vegetation with a high wildlife value. To minimize the risk of contamination, refuge equipment is regularly maintained and inspected before each use. Under all alternatives, use of herbicides in wetland habitats, as described in the IPM Plan, would have negligible to minor effects on wetland habitats and associated wildlife.

6.5.2 Effects to Wetland Habitats and Wildlife from Public Recreational Use

Waterfowl and Upland Game Bird Hunting

Waterfowl and upland game bird hunting are allowed on 2,510 acres of the Refuge under all alternatives. Effects to waterfowl and waterbirds are discussed in Section 6.3.3 above. Direct effects to wetland habitat and wildlife from the waterfowl and upland game bird hunting are difficult to measure, but would likely be minimal for the following reasons:

> 1) A small percentage of the Refuge's fall waterfowl habitat lies within either the waterfowl hunt areas, and currently the Refuge cannot reliably maintain water in the hunt area in the fall.
>
> 2) Although hunters would access their positions via cross-country travel which can trample vegetation and disturb wildlife, this impact is expected to be low because of small numbers of hunters and the time of the year.
>
> 3) Breeding wildlife are not present, and most vegetation is dormant and resistant to damage, during the waterfowl and upland game bird hunting seasons.

Migratory and resident birds of various species and other wildlife may be interrupted while foraging or forced out of resting habitat or thermal cover, causing an unnecessary expenditure of energy and possibly subjecting them to increased risk of predation or weather-related stresses. These disturbances are quite difficult to measure, and are likely minor, since waterfowl hunters typically will follow an established route or trail to blinds, and most distances to hunting locations are short. Periodic firearm discharge in close proximity to wetlands can result in behavioral responses by waterfowl and other wetland birds; however, due to the low numbers of waterfowl and upland game bird hunters using the Refuge, this disturbance would be expected to be infrequent. There is also some trampling of vegetation associated with accessing blinds, setting up decoys, and retrieving downed birds, but this is primarily restricted to trails leading to blinds and the immediate vicinity of the blinds and is considered to be negligible on a refuge level.

Elk Hunting

Big game hunting is prohibited in Alternative 1 (Current Management). In Alternatives 2 and 3 we propose to establish an elk hunt on 4,112 acres of the Refuge, in line with State seasons and regulations for GMU 63. The season for GMU 63 runs for five months (August 1-December 31). While elk hunting would occur within or adjacent to wetlands, meadows, sage-steppe, and riparian habitats, negative impacts to these habitats and their associated species are likely to be minor because the elk hunting program would involve a small number of widely dispersed individuals over a broad period of time (a maximum of 20 hunters over the five-month hunt season and a maximum of two elk hunters allowed on the Refuge at any given time). Hunters can spread invasive species by varied mechanisms, such as transport on equipment, clothing, footwear, and hunting dogs. These impacts are very limited in scope and duration and would result in minor impacts to the Refuge's wetland habitat.

Elk hunting on the Refuge could also disturb some non-target wildlife species. Disturbance to the daily activities, such as feeding and resting, of migrating or wintering non-hunted birds and other wildlife might occur. Hunting causes disturbance to non-target species because of noise (most notably the report of a firearm), human presence and general disturbance associated with the activity. These disturbances are manifested by alertness, fright (obvious or unapparent), flight, swimming, disablement or death in non-target species (Dahlgren and Korschgen 1992). This effect is likely a minor negative effect due to the low numbers of hunters using the Refuge (both at any given time, and total over the season). The majority of elk hunting would occur in the fall, after the nesting and rearing season for most birds and other wildlife has been completed; therefore, reproduction of most species would not be directly impacted by hunting. The amount and degree of disturbance to other wetland-dependent wildlife would depend on the condition of the refuge wetlands, in particular Rays Lake and Sandhole Lake. Effects to migrating waterfowl and sandhill cranes are discussed in Section 6.3.3 above. Periodic shooting, or hunters walking in close proximity to these wetlands, could temporarily disperse wildlife. This disturbance would be limited in scope by the low number of hunters at any given time (maximum of 2 two daily). The rate of gunfire discharge is expected to be infrequent and random based upon opportunistic individual shots at elk in range. The frequency of gunfire may be only a few shots per day at most, causing temporary and short- term disturbance.

Refuge regulations further mitigate possible disturbance by hunters to non-hunted wildlife. Vehicles (except refuge-owned utility terrain vehicles used to transport disabled hunters and retrieve game harvested by disabled hunters) are restricted to roads. Refuge personnel or a designated volunteer would take disabled hunters to and from hunting blinds and assist in retrieval of game, which may require off-road travel; however they would use travel routes that minimize off road travel and disturbance to non-hunted wildlife.

Because the number of elk hunters on the Refuge is limited to two at any given time, and a total of 20 over the hunting season (August 1-December 31), disturbance to wildlife that use wetlands within the elk hunt area is expected to be infrequent, and of a minor and temporary nature. Additional hunt stipulations, including a required orientation and selective closures of areas were sensitive wildlife resources are present, the elk hunt proposed in Alternatives 2 and 3 would be expected to have only minor negative effects on wetland habitat and wildlife.

Wildlife Observation, Wildlife Photography, Interpretation, and Environmental Education

Wildlife observation from the auto tour route, roads, off-road hiking, birding, and walking trails, wildlife observation platforms, photo blinds, and refuge-led wildlife-based tours have direct and indirect impacts on wildlife use of wetland habitats. Wildlife observers traveling along trails and roads can disturb migratory and resident birds of various species and other wildlife by interrupting foraging or forcing animals out of resting habitat or thermal cover, causing an unnecessary expenditure of energy and possibly subjecting them to increased risk of predation or weather-related stresses. These disturbances are quite difficult to quantify. However, research indicates that wildlife avoid wetland habitats in close proximity to public use facilities, such as the auto tour route, due to the frequent presence of visitors (Cline et al. 2007; Klein 1993). A detailed discussion of the disturbance effects of nonconsumptive recreation to waterfowl and waterbirds is included in Section 6.3.2 above.

Under all alternatives, public use is expected to increase over time as a result of increasing regional populations, increasing demand for wildlife-dependent recreation, and a greater awareness of the Refuge. Increasing visitation would cause greater impacts to wildlife and habitat in Alternative 1 than in Alternatives 2 and 3, in part because off-road hiking is allowed throughout the Refuge from July 15-February 28 in Alternative 1, and because Alternatives 2 and 3 provide for additional staffing and facilities to manage visitor use. As noted in Section 6.3.2 above, under all alternatives, vehicle, bicycle, and pedestrian access would be allowed year round on the 6.3-mile auto tour route, and bicycle and pedestrian access would allowed year-round on 27 miles of service roads. An additional 6.5 miles of hunter access roads leading to the north and south hunt units would be open to vehicle, bicycle, and pedestrian access during the waterfowl and upland game hunting seasons. Alternative 1 (Current Management) has the greatest potential for wildlife disturbance, since the entire 10,806-acre Refuge open to off-road hiking from July 15-February 28. In the Preferred Alternative (Alternative 2), off-road hiking would be prohibited. Up to five personal portable photo blinds would be allowed within 100 feet of roadways at any given time. Eight refuge-led wildlife-based tours would be conducted annually. Alternative 2 would increase refuge environmental education and interpretation programs, to increase visitor success in seeing wildlife and provide access to areas that are otherwise closed to the public. Alternative 2 would provide opportunities to serve a targeted audience while minimizing undesirable impacts to wetland wildlife. At Camas NWR there are several key periods when birds or other wildlife are reliably present and active enough to warrant regular guided tours, for example the snow goose migration, the fall rut (elk, white tailed deer), and bald eagle roosting in winter. While some degree of wetland wildlife disturbance would occur from implementation of the public use program in the Preferred Alternative (Alternative 2), the increases in public awareness of wetland and upland species diversity and ecology, understanding of Camas NWR habitat management actions, interpretation of refuge energy and water conservation actions, and appreciation for the mission of the National Wildlife Refuge System, combined with elimination of off road hiking, would offset these minor impacts to wetland-dependent species.

Alternative 3 would have a greater impact to wetland habitats and associated wildlife than Alternative 2, primarily due to re-opening of the 7.5 Sandhole Lake loop road to vehicle traffic, but also from construction of three permanent photo blinds, and conducting more guided wildlife-based refuge tours (up to twelve annually). However the reduction in free roam hiking (allowed on 2,510 acres only in Alt 3), allowing a maximum of five portable photography blinds on the Refuge at any given time, and requiring that these blinds be placed no more than 100 feet from roads, would at least partially offset these impacts.

Overall wetland habitat and wildlife impacts from wildlife observation and wildlife photography activities associated with Alternative 2 are likely to slightly less than those associated with the No Action alternative, primarily due to the prohibition of off road hiking in Alternative 2. Alternative 3's effects would be intermediate between those of Alternatives 1 and 2, primarily due to opening the 7.5 mile Sandhole Lake road to vehicular traffic. However this would be at least partially offset by prohibiting off road hiking on most of the Refuge.

6.5.3 Overall Effects to Wetland Habitats and Wildlife

Considering the relationships of wetland habitat and quality characteristics, Alternative 2 would best simulate a natural range of deep and shallow marsh and promote high wetland productivity over the lifetime of the CCP. Alternative 1 water management strategies are more prescriptive in nature to provide consistent deep marsh habitat, and require constant mechanical (e.g prescribed fire) or physical disturbance regimes across the Refuge to break up monotypic stands of emergent vegetation. Prescribed fire would be used in all alternatives to break up dense stands of emergent vegetation, remove residual vegetation, and create habitat mosaics. We expect greater use of prescribed fire in hemi-marsh habitat in Alternative 1 than Alternatives 2 and 3; however changes in timing of prescribed fire under Alternatives 2 and 3 may provide longer term habitat improvement.

While management actions described under Alternative 1 would improve habitat conditions in wetlands, wetlands would remain relatively static over time, and productivity would be lower than is more dynamically managed wetlands proposed in Alternatives 2 and 3. It is also likely that over time, maintaining a consistent availability of deepwater wetlands throughout the breeding season, and from year to year, would become less attainable due to the region's lowering water table. The implementation of Alternatives 2 and 3 would mimic the natural processes that shaped the marsh, while still providing dynamic and variable hydrology. By increasing seasonal wetland habitat at Camas NWR, the Refuge would be able to provide diverse and critical migration and breeding habitat to waterfowl, wading birds and other wildlife species. Of particular importance, the shallow, extensive wetland habitats on this site would provide important feeding and resting habitat for spring migratory waterbirds that breed in Alberta, Saskatchewan, Alaska and other northern breeding areas (Ivey and Herziger 2006). The restoration and increase of seasonal wetland habitat will provide breeding habitat for several species at Camas NWR, including mallards, Canada geese, northern shovelers, gadwalls, cinnamon teal, and blue-winged teal.

Finally, implementation of the Wetland and Riparian Rehabilitation Plan in Alternatives 2 and 3 would likely result in an increase wetland productivity from 2017 to 2027, while conserving water resources. By conducting geomorphological, hydrological, and biological assessments and pilot projects prior to developing the Plan, the Refuge would better understand how the riparian system and adjacent wetland habitats may respond to larger scale rehabilitation efforts, leading to the development of realistic and achievable objectives. Overall, the actions under Alternative 2 would likely result in a moderate positive effect to both wetland habitat quantity and quality for associated species. Wetland management in Alternative 3 would be the same as Alternative 2, however the equal emphasis of upland and wetland management in Alternative 3 would reduce resources available for wetland management compared to Alternative 2.

Under all alternatives, the refuge hunt and public-use programs would have negative effects on wildlife (primarily through disturbance) and habitat (e.g. trampling of vegetation), but these effects are considered minor to moderate in Alternative 1, and minor in Alternatives 2 and 3.

6.6 Effects to Riparian Habitats and Associated Species

There are two main riparian drainages in the Beaver-Camas sub-basin: the Beaver Creek drainage and the Camas Creek drainage. Both of the drainages receive their flow from the mountainous regions in the upper watershed. Due to natural infiltration and diversion for irrigation streams in the lower two-thirds of the sub-basin are seasonal or intermittent. Three streams, Camas Creek, Beaver Creek, and Warm Creek, flow through the Refuge. The major refuge stream is Camas Creek, which flows through the entire Refuge before exiting and terminating west of the Refuge at Mud Lake, the endpoint for all drainage in the subbasin. Beaver Creek is a small tributary of Camas Creek that enters the Refuge just before its confluence with Camas Creek. Warm Creek branches off of Camas Creek just upstream of the refuge boundary and flows onto the Refuge to terminate at Mallard Slough.

Camas Creek is the heart of a complex irrigation system where groundwater is pumped into the modified creek channel to supply irrigated agriculture. Camas Creek is a degraded, incised, and highly unstable riparian corridor, heavily influenced by anthropogenic modification and adjacent land use practices. The effects of dredging and channelization on the Camas Creek corridor by various water users is substantial and obvious, and include: reduction in frequency of overbank flooding (floodplain inundation); reduction or elimination of natural channel migration; elimination of sediment beds used as plant recruitment areas; reduction or elimination of large woody debris in the channel; and lowering of groundwater tables.

Approximately 278 acres (2.6 percent) of Camas NWR is classified as willow riparian or wetland (scrub-shrub) habitat. This includes both linear bands of willows along Camas Creek (20-40 acres), more extensive areas of willow in the Rays Lake/Sandhole Lake areas. The Rays Lake/Sandhole Lake willow stands are considered wetland (palustrine scrub/shrub) habitat types and are considered in Section 6.3.1 above. Willow riparian habitat associated with Camas Creek is specifically considered in this section. Differences between alternatives in effects to riparian habitat and associated wildlife are the result of changes in the quantity and quality of riparian streams and woodlands through changes in the management of riparian and wetland habitat, fire, invasive species, and public use (hunting, wildlife observation, photography, and environmental education).

6.6.1 Effects to Riparian Habitats and Wildlife from Habitat Actions

Effects from Riparian Habitat Management

Alternative 1 (Current Management) would maintain 4 miles of in-stream habitat and the existing 20-40 acres of willow riparian habitat along Camas Creek. Both Alternatives 2 (Preferred Alternative) and 3 would increase in-stream and willow riparian habitat along Camas Creek, and would extend and augment streamflow to increase in-stream habitats from 4 to 8 miles in the summer. These alternatives would attempt to restore up to 80-130 acres of native willow woodlands. This represents a 250-750 percent increase in refuge willow riparian habitat in Alternatives 2 and 3. The increased acres would provide nesting habitat for additional pairs of riparian dependent passerines (e.g., willow flycatcher, yellow warbler) and stop-over habitat for hundreds of migrants annually.

In Alternatives 2 and 3, suitable areas of willow riparian habitat would be managed for increased recruitment and regeneration of woody vegetation. These alternatives would maximize shrub density while managing for periodic disturbance to reinvigorate woody riparian stands. The greatest negative impact to riparian shrub habitat over the last century has been past grazing practices and the purposeful eradication of riparian habitats (e.g. mowing willows in the Camas Creek channel) as to not impede water delivery. Impacts to woody riparian communities at Camas NWR have been reduced through the removal of on-refuge grazing in 1993. The result has been an increase in both the quantity and quality of this habitat type on the Refuge. To continue this upward trend, existing and potential willow riparian habitat would be protected from unnecessary impacts. In target areas that are either disconnected from the floodplain, or lie outside of floodplain areas, supplemental soil moisture via flood irrigation would be used to sustain existing acres of this habitat and promote expansion. Strategic plantings would be used to increase shrub species diversity. Prescribed fire and mowing treatments would occur within riparian woodlands, but would be infrequent and balanced by the need for older stands of dense, undisturbed willow/shrub areas according to focal species needs and designated acreages. Due to these management changes, yellow warblers, willow flycatchers, and other species that require dense thickets of deciduous riparian shrubs for feeding and/or reproduction would receive moderate positive benefits from Alternatives 2 and 3.

Riparian systems may attract up to 10.6 times the number of migratory birds found in surrounding upland sites in the spring (Stevens et al. 1977) and fourteen times the number of species recorded during fall migration (Hehnke and Stone 1979). These differences occurred almost exclusively in the insectivorous bird foraging guild, with granivorous species being associated more with upland (Stevens et al. 1977) or altered (Heller 1978) sites. However, granivorous species do use riparian sites extensively during winter for foraging and thermal cover (Samson and Knopf, unpubl. data, reported in Knopf et al. 1988). The high value of restored riparian habitat in Alternative 2 (Preferred Alternative) extends beyond the values to birds, and includes positive benefits to amphibians and reptiles (Brode and Bury 1984; Bury 1988), small mammals (Cross 1985; Doyle 1990), and big-game (Collins and Urness 1983). Overall, there would be a moderate positive effect to species that benefit from riparian habitat (e.g. breeding landbirds, spring and fall migrant landbirds) due to the increase in willow riparian habitat.

Effects from Development and Implementation of Wetland and Riparian Restoration Plan

As noted above, Camas Creek and its associated floodplain have undergone numerous anthropegenic changes since the late 1800s, including reduction in frequency of overbank flooding (floodplain inundation); reduction or elimination of natural channel migration that leads to formation of point bars that provide bare soils for plant recruitment; reduction on instream and streambank woody vegetation due to livestock grazing or intentional removal; reduction or elimination of large woody debris in the channel; and lowering of groundwater tables. These changes have combined to create major effects to riparian ecosystems, for example, shifts in plant composition from mesic to xeric species and decreases in the overall extent of riparian ecosystems. The loss of riparian vegetation in turn, can affect stream channel stability by increasing bank erosion and resulting in channel degradation or aggradation (Rosgen 1996).

Overbank flooding is a key hydrologic process that affects riparian water table dynamics and ecological processes such as biogeochemical cycling and plant diversity (Naiman and Décamps 1997). Overbank flooding typically occurs for a few days to weeks once every one to two years for most natural rivers (Wolman and Leopold 1957); this alternation of wet and dry phases enhances biotic diversity and productivity in riparian areas (Junk et al. 1989). Confinement of flood flows to the channel eliminates the periodic inundation of the floodplain, and thereby decreases the level of soil moisture in the riparian zone. Currently, minimal overbank flooding occurs about once every six years, and inundation of the floodplain occurs only infrequently on the Refuge (about once every 20 years).

Alternative 2 (Preferred Alternative) and Alternative 3 attempt to address an urgent need to rehabilitate channel integrity, to not only stabilize Camas Creek’s altered morphology, but improve habitat diversity and the ecological and amenity value of refuge riparian habitat. Restoration and management objectives and approaches are most effective when based on an understanding of ecosystem processes and the long- and short-term causes of disturbance (Wohl et al. 2005). Before management objectives for wetland and riparian habitats can be developed, the Refuge must first assess its physical setting to determine the most appropriate strategies and tools for wetland management.

Therefore, in Alternatives 2 and 3 we propose to develop a Wetland and Riparian Rehabilitation Plan (WRRP) and associated NEPA document by 2017. The long term goal of the Plan would be to work within Idaho water law and existing water rights to restore the structure and ecological function of the Refuge reach of Camas Creek. The Plan would be developed in three phases. In the first phase (assessment; 2014-2015) we would collect data (geomorphological, hydrological, and biological assessments) in order to better characterize current conditions and evaluate watershed-scale data (Munro et al. 2007). Concurrently (2014-2017), the Refuge would implement and monitor pilot rehabilitation projects over the next four years to gain a better understanding of how the riparian system and adjacent wetland habitats may respond to larger scale rehabilitation efforts, and assess the efficacy of potential refuge water conservation and delivery projects. For example, between 2014 and 2017, the banks of Camas Creek would be lowered in strategic locations to increase the occurrence of natural overbank flooding into refuge wetlands and evaluate effects on habitat condition and wildlife use of these habitats.

Using the results of data collection and pilot projects, we would draft a Wetland and Riparian Rehabilitation Plan (and associated NEPA document) by 2017. The Plan would include long-term management objectives to support an integrated approach to rehabilitating wetland and riparian habitats. The Plan would be based on a careful assessment both of the dominant geomorphic and hydrologic controls and of the causes of disturbance at watershed, valley segment, and site scales. This plan would also consider the current magnitude of incision or degradation and the potential for stream stabilization and vegetation management (Chambers and Miller 2011). Implementation of long-term rehabilitation efforts would be conducted from 2017-2027. The Preferred Alternative (Alternative 2) and Alternative 3 would provide a realistic timeline to complete and implement the WRRP within the lifetime of the CCP. Alternatives 2 and 3 also offer the advantage of using other available resources if they become available through agency funding, partnerships, etc. to conduct assessments and pilot projects necessary for developing the WRRP.

The Wetland and Riparian Restoration Plan would identify strategies to restore overbank flooding of Camas Creek on the Refuge, guided by results of the pilot project to lower banks in strategic locations. Restoration of overbank flooding may be accomplished by restoring the channel of Camas Creek within the Refuge to its historic depth, either by lowering the banks of Camas Creek to the mean high water mark, or raising the bottom of the channel, which is currently deeply incised. This restoration would re-initiate natural periodic overbank flooding events to refuge riparian habitats, and would impart substantial positive benefits to both riparian habitat and associated wildlife. Riparian soil water and groundwater recharge would be greater during overbank flooding in Alternative 2, than recharge due to precipitation events in Alternative 1 (Girard et al. 2003; Kingsford 2000; Stanford and Ward 1988; Workman and Serrano 1999). By contrast, Alternative 1 (Current Management) would allow the banks of Camas Creek to remain altered (diked and incised) with substantial overbank flows occurring only occasionally (once in 20 years) during severe flood events. Overbank flood events have generally been regarded as the main hydrologic mechanism for replenishing groundwater and soil water in riparian areas (Girard et al. 2003; Workman and Serrano 1999); however, this would continue to rarely occur in Alternative 1.

In Alternative 1, the Mud Lake irrigators would continue to be allowed to remove all “debris” and regenerating willows within refuge stream channels, as allowed under State regulations (Alteration of Channels and Streams, Title 42; Chapter 38). The Preferred Alternative (Alternative 2) and Alternative 3 would seek collaborative common ground solutions with the Mud Lake Water Users to ensure the rightful conveyance of Camas Creek waters to Mud Lake while restoring important riparian habitat processes, such as in-stream debris maintenance. If such a solution is reached, this would result in a number of benefits to Refuge riparian habitat and associated wildlife, including increased habitat complexity, a more natural channel profile, and increased storage of sediment and organic matter (Bisson et al. 1987). This combination of structural complexity and increased nutrient availability would be expected to result in increased populations and species diversity of invertebrates, fish, amphibians, birds, and mammals (Bartels et al. 1985; Bilby and Bisson 1998; Maser and Sedell 1994; Steel et al. 1999).

The Plan would also attempt to restore, to the degree possible, the historic channel configuration of Camas Creek within the refuge boundary. Effective management practices designed to reduce, rather than eliminate, channelization would likely be required (Brookes 1988; Henderson 1986). While an engineered solution may be necessary to rehabilitate channel integrity, the approach of Alternatives 2 and 3 is likely to be sustainable and, therefore, more cost effective than some traditional heavy handed engineering solutions (Hey 2006; Rosgen 1994). Because riparian ecosystems are dependent on their watersheds, larger scale watershed and river basin approaches to restoration may be necessary to solve process oriented problems within Camas Creek (DeBano and Schmidt 1989a,b, 1990; McGlothlin et al. 1988). In addition to watershed treatments, in-channel structures may be required to stabilize channels, reduce sediment, and extend the duration of streamflow (DeBano and Schmidt 1989a,b). If the watershed cannot be restored, the stream channel and riparian zone must be rehabilitated to a state in equilibrium with the watershed's ongoing water-sediment production regime (Brookes 1987; Morris 1995).

The rehabilitation of aggraded Camas Creek gullies would be extremely challenging and expensive. Treatment options identified in the Camas NWR Wetland and Riparian Rehabilitation Plan must include measures to deal with multiple mechanisms of erosion that may occur at different times and under different hydrologic conditions (Ponce and Lindquist 1990).

Although the Preferred Alternative (Alternative 2) and Alternative 3 have an ecologically based approach to riparian rehabilitation of Camas Creek geomorphic form, neither alternative guarantees restoration of all geomorphic processes. For example, the level of restoration that may be achievable through refuge rehabilitation efforts would be constrained by the need to prevent flooding of private lands and structures. Consequently, return to pre-settlement conditions is an unrealistic goal for the CCP within this dynamic refuge riparian ecosystem (Chambers and Miller 2011). Still, the Wetlands and Riparian Rehabilitation Plan outlined in Alternatives 2 and 3 is based on a sound scientific approach, allows for testing of hypotheses on smaller scales before investing in large projects, and offers high potential for preventing further degredation and at least partially restoring natural hydrogeologic function of Camas Creek.

Wetland Management

Alternative 1 (Current Management) would continue to divert 58.1 cfs (almost all of Camas Creek surface waters in an average water-year) from April-July to inundate and manage extensive hemi-marsh habitats within the Refuge's six core wetland impoundments. Riparian habitats within the Camas Creek floodplain would only receive surface flows below the refuge diversion point for only three to six weeks/year, when flows actually exceed 58.1 cfs. The Refuge would continue to allow the banks of Camas Creek to remain altered (diked and incised) and minimal overbank flooding would occur into refuge wetland and riparian habitat. Incision of Camas Creek would continue to occur, and the water table would continue to drop. As a result of these processes, all or part of the Refuge's natural wet meadow wetlands would eventually transition to a new drier ecological type with a new site potential (Leopold et al. 1964). Shifts to drier ecological types are likely to exacerbate the spread of weeds. Under Current Management (Alternative 1), stream diversions, modifications of springs and seeps, and extensive groundwater pumping, would continue to occur, with direct and indirect effects on wet meadow water tables. Further water-table declines would be expected due to management emphasis on extensive deep hemi-marsh wetlands. Due to water table declines, inefficient water applications, and outdated infrastructure, shifts in meadow plant composition from mesic to xeric species and a decrease in the overall extent of the wet meadow wetland ecosystem would be expected under Alternative 1 (Rosgen 1996).

Alternatives 2 and 3 would decrease the refuge emphasis upon hemi-marsh habitats and increase the extent of shallow wetlands annually within two of the six impounded wetland basins (i.e., Big, Redhead, Toomey, Spring, Center and Two-way Ponds). Since some wetland impoundments possess tighter pockets of natural hydric soils, they are anticipated to hold water longer and therefore can be managed for deeper hemi-marsh habitats while making more efficient use of refuge diversions of riparian surface waters. By reducing the number of wetlands that are maintained as deepwater habitat, more of Camas Creek flows would be available for application to riparian habitat. In Alternatives 2 and 3 we would move the main point of diversion and the irrigation wells downstream, closer to the managed wetlands. By lessening the distance water would need to travel from point of diversion to the wetland impoundments, the Refuge would decrease water losses from ground subsidence and evaporation, and increase cfs flows within the riparian corridor. Overall, in comparison to Alternative 1, wetland management under Alternatives 2 and 3 would result in moderate positive effects to the riparian habitats of Camas NWR due to a more efficient application of surface water and reduced emphasis on hemi-marsh management.

Upland Management

Management and rehabilitation of upland habitats would be minimal in Alternative 1 (Current Management), and predominantly consist of invasive species control and access restrictions. The Refuge would continue implementation of small sagebrush restoration projects on approximately 90 acres in areas currently dominated by non-native grasses.

Alternative 3 elevates upland habitat restoration as coequal to wetland/riparian rehabilitation, and would likely compete for limited resources (refuge staff time, as well as grant opportunities and partnership involvement). Alternative 2 (Preferred Alternative) emphasizes wetland/riparian rehabilitation while moving forward strategically with more limited upland habitat rehabilitation. Alternative 2 allows for flexibility in the amount of progress that is made in upland habitat management, depending on the availability of resources (see section 6.7.1 below).

Shelterbelt Management

In both Alternatives 1 and 3 a combination of surface water diversions and groundwater pumping would be used to surface irrigate shelterbelt habitats. This is an inefficient use of water, since only about half of applied water actually reaches plantings. In addition, Alternative 3 would expand shelterbelt from 34 to 50 acres, a 40 percent increase. Alternative 2 (Preferred Alternative) would use a combination of partial groundwater irrigation and a highly efficient micro-drip irrigation system to provide water to newly established shelterbelt plantings within the current footprint (34 acres). Of the three CCP alternatives, Alternative 2 (Preferred Alternative) provides the most water efficient management for naturalized shelterbelt habitat, while not compromising refuge objectives for the rehabilitation of Camas Creek riparian habitat functions.

Fire Management

Under natural fire regimes the perennial stream woodlands of the upper Great Basin, such as Camas Creek, probably burned infrequently. In eastern Idaho, the mean fire return interval was estimated to be 48 years in some riparian communities (Barrett 1988). In the Klamath Mountains of northern California, Skinner and Chiru (1996) found that the median fire return intervals were twice as long in riparian reserves as in upland sites, suggesting that fires occurred less frequently in riparian areas. During very dry years, if the vegetation was sufficiently stressed, the natural riparian meadows and willow stands may have burned. More often in healthy riparian communities, fires would probably stop at the edge of the wet meadow riparian zone, as was observed by DeBenedetti and Parsons (1979) in a similar riparian ecosystem. The continuous stream channel probably functioned as a natural fire break, particularly along alluvial reaches where extensive, unvegetated gravel bars may slow or halt an advancing fire front.

Higher soil moisture content can curtail and slow the rate of fire spread within riparian zones. For example, wet meadows, where moisture content of fuels and soils are generally higher than in surrounding uplands, may serve as fire breaks until late in the fire season (Dwire and Kauffman 2003). Because fire behavior is influenced by fuel characteristics, the variation in riparian vegetation likely contributes to the tendency for many fires to burn in a patchy manner through riparian areas. These speculations are tentative, however, since few data are available on fuel loads, fuel chemistry, or fuel moisture for most common riparian plant communities, and on how the distribution of fuels influences fire behavior in stream-riparian corridors (Dwire and Kauffman 2003).

Impacts of current land use practices (i.e., groundwater pumping) may now strongly influence fire properties in some riparian areas. Where streams and riparian areas have been degraded by land and water use, fire properties may begin to resemble the drier uplands. For riparian-stream corridors, some models predict that human alterations in vegetation, hydrology, and geomorphology increase the probability of high severity fires and reduce the capacity of riparian features to act as natural fire breaks (Dwire and Kauffman 2003). In the Southwest, Busch (1995) documented that the current frequency and intensity of fires in riparian habitats is greater than what occurred historically because: (1) a greater accumulation of fuels due to a reduced frequency of scouring floods and; (2) the expansion and dominance in many areas of invasive species which are more flammable.

The strategies outlined in Alternative 2 (Preferred Alternative) and Alternative 3 would mimic the effects of natural low to moderate-intensity fires that once occurred in Camas Creek woodlands. We would promote natural willow regeneration in established stands by physically, biologically, or mechanically treating 10 percent of large old stands per season to create diverse willow patches with both mature and early successional states. This may involve the use of patchy, low intensity prescribed fire, or other techniques. Most shrub willow species are able to re-sprout after low to moderate-intensity fires that kill only the aboveground plant parts. Riparian species exhibit a range of adaptations to disturbance that contribute to the rapid recovery of streamside habitats following fire. These include adaptations that facilitate the survival of plants on-site, such as sprouting and thick bark, and those that contribute to recolonization of burned sites, including wind and water dispersal, reproductive responses, and the capacity to establish in post-fire environments (Kauffman 1990; Miller 2000; Stickney 1986). In uplands, shrub survival is related to fuel consumption (Kauffman and Martin 1990). Fire-caused tree and shrub mortality is highest when the litter layer and soil organic horizons are consumed by fire, and root crowns and other belowground tissue are killed (Kauffman and Martin 1990; Stickney 1986). In riparian areas, higher levels of soil moisture may prevent the combustion of soil organic matter and protect belowground tissues, thus increasing the probability of shrub survival. Most riparian sedge (*Carex* spp.) and grass species recover rapidly following light surface fires through regeneration from roots and rhizomes (Racine et al. 1987: Figure 5). Under the low intensity prescribed fire regimes of Alternatives 2 and 3, thick bark would protect the cambium of tree species that occur in riparian areas and allow natural re-sprouting (Miller

2000). The post-burn re-sprouts of many willows have a high growth rate and are preferentially foraged upon by elk (Leege 1979; Stein et al. 1992). In Alternatives 2 and 3 we propose to use patchy low intensity fires to create mosaics of shrub stands with different canopy heights and stem densities. Summer prescribed burns in riparian habitats would be avoided, as they can result in high-intensity fires that burn deeply into the soils and kill the willow roots, thereby eliminating the possibility of basal sprouting (Finch and Stoleson 2000; Uchytil 1989; USFWS 2002). In summary, under Alternative 1 willow stands would continue to progress toward late successional stages. Management proposed under Alternatives 2 and 3 would result in a mosaic of willow habitat in various successional stages, which would benefit a wide array of wildlife species, including migratory landbirds and ungulates.

Invasive Species Management

Increased effort to control invasive species would be undertaken in Alternatives 2 and 3 to protect and maintain existing riparian woodlands and aquatic in-stream habitat. Riparian management in Alternatives 2 and 3 would entail controlling invasive species to increase establishment of native understory vegetation, and enhancing recruitment of native trees. All invasive plant treatment methods have the potential to temporarily disturb, displace, or directly harm various wildlife species. All weed control, mechanical, cultural, chemical, and biological control methods would be individually evaluated (see Appendix F, for descriptions of general weed control methods) before use and application. Chemical usage would be subject to provisions of the refuge IPM plan (Appendix F). Among other provisions, the IPM plan provides direction that “the most efficacious pesticide available with the least potential to degrade environmental quality (soils, surface water and groundwater) as well as least potential effect to native species … would be acceptable for use on the Refuge.” Each approved pesticide would undergo a chemical profile analysis; active ingredients would be analyzed for their risk quotient and this value compared to a Level of Concern for surrogate species, as established by the EPA. Adverse negative effects would be avoided by the Refuge’s standard operating procedures for the use of only registered and labeled aquatic herbicides in riparian habitats and strict conformity to the specific pesticide label requirements. Although IPM would be used to control invasive species under all alternatives, Alternatives 2 and 3 would result in greater positive effects to riparian habitat than Alternative 1.

6.6.2 Effects to Riparian Habitats and Wildlife from Public Recreational Use

Alternative 3 supports the largest increases in public uses of Camas NWR. In comparison to Alternative 1 (Current Management), the Preferred Alternative (Alternative 2) accounts for a small increase in public recreational opportunities affecting riparian habitat and wildlife.

Recreational use of the riparian zone is usually many times that of other habitats, particularly in areas proximate to more suburban and urban areas (North Central Forest Experiment Station 1977; Sachet 1988). Vegetation alteration at recreation sites occurs as a result of trampling, with herbaceous and shrub layers usually the most affected (Reese and Blakesley 1987; Settergren 1977). These layers are particularly important to nesting songbirds, amphibians, small mammals, and other species that require thick and multi-layered vegetation for protective cover, food gathering, and microclimate control (Bull and Skovlin 1982; Doyle 1990; Weaver et al. 1979). Riparian shrub-oriented species such as McGillivray’s warbler and lazuli bunting may be fewer in number or absent at recreational sites. But species that nest and feed within tree canopies, such as squirrels and warbling vireo, may be unaffected by recreational development because mature trees are often spared at recreation sites (Reese and Blakesley 1987).

Although information found in a literature review provided by Sachet (1988) was not specific to riparian areas, it does provide some insight to potential impacts in riparian areas as a consequence pedestrian based recreation. General conclusions of wildlife habitat impacts by forms of recreation have been summarized by Sachet (1988) and include:

Indirect Effects of Riparian Recreation

- Increased bare ground, trail width, trail depth, soil compaction, and soil bulk density;
- Increased potential for soil erosion;
- Reduced trailside vegetation, vegetative cover, and organic matter in the soil;
- Tree damage.

Direct Effects of Riparian Recreation

- Disruption of normal activity patterns and habitat selection of big game;
- Human disturbance of all wildlife.

Aquatic and near-shore riparian habitats are especially vulnerable to physical disturbance. Trampling and removal of emergent vegetation and woody debris all contribute to the direct degradation of these habitats (Aitchison et al. 1977). Recreation can impact riparian vegetation through damage or destruction of plants, elimination of seedlings, promoting invasion by exotic species, increased incidence of fires, indirect effects from soil compaction, and bank erosion (Johnson and Carothers 1982). Noise and the approach of human beings to breeding sites, spawning reaches, feeding areas, or resting cover is distressing to most wild animals (Braun et al. 1978; Skagen 1980). Disturbance from human recreation can reduce both the density and diversity of avian communities (Aitchison et al. 1977; Riffell et al. 1996; Szaro 1980; Taylor 1986). In riparian areas in Utah, the presence of willow flycatchers was negatively correlated with high traffic areas (e.g., parking areas, trail heads, restrooms, campgrounds (Blakesley and Reese 1988). Food scraps and garbage in areas of high recreational use attract larger birds (e.g., jays, ravens) and small mammals (skunks, squirrels) which prey on bird nests and recently-fledged young (Blakesley and Reese 1988; Johnson and Carothers 1982). Abandonment of the habitat due to human disturbance may occur even in the presence of suitable vegetative conditions (Taylor 1986). Negative reactions to disturbance are heightened when animals are also stressed by malnutrition, parasites, or inclement weather, and also when suitable habitat is fragmented and/or limited in size (Harris 1988).

Alternative 1 (Current Management) offers the greatest public recreational access to riparian habitats, with the entire 10,806-acre Refuge open to off-road hiking from July 15-February 28, which includes part of the breeding season for migratory birds that use this habitat. All refuge riparian habitat would be accessible to off-trail dispersed recreation under Alternative 1. In comparison to Alternative 2 (Preferred Alternative) and Alternative 3, Alternative 1 (Current Management) would result in the greatest riparian wildlife disturbance. While the 1997 Refuge Improvement Act recognizes that wildlife-dependent recreation is an appropriate use of Refuge System lands, the Act also mandates that the needs of wildlife come first on refuges. Allowing unrestricted access to portions of refuge riparian areas during the end of the breeding season in Alternative 1 could cause unacceptable levels of disturbance to migratory birds within riparian habitats.

Alternative 2 (Preferred Alternative) would allow the use of personal portable photo blinds within 100 feet of roadways and increase the number of refuge-led wildlife observation tours, but would prohibit off road hiking completely. Alternative 3 contains the most provisions to increase public use facilities and activities, including opening the 7.5 mile Sandhole Lake road to vehicle traffic, constructing three permanent photo blinds in riparian woodlands and the use of personal portable photo blinds within 100 feet of roadways, and moderate increases to refuge-led wildlife observation tours. However, Alternative 3 limits off-road hiking to 2,510 acres (the north and south waterfowl hunting units). Under both Alternatives 2 and 3, the current half-mile long birding trail, which takes visitors through shelterbelt and willow riparian habitat, would be lengthened to 1.3 miles. By limiting off road hiking or eliminating it entirely, both Alternatives 2 and 3 would minimize disturbance from wildlife based recreation to riparian habitat and wildlife.

Refuge riparian habitats provide ample winter cover for big game species such as moose, white-tailed deer, and elk. Compared to the open sagebrush and agricultural habitats, which surround refuge lands, the proportional quantity and quality of refuge security habitat is of a higher value and quality for wintering big-game than the adjoining private property. In the past two decades incidental counts of the number of elk using Camas NWR in the fall and winter have been on the increase. Elk use the protection of refuge habitats from human disturbance and hunting pressure during the day and forage on private hay pastures and hay stacks at night. Unfortunately, this has caused conflicts between elk and people (e.g., depredation to farms and feedlots).

In Alternatives 2 (Preferred Alternative) and 3, a new hunt unit would be established for elk hunting. This unit would be approximately 4,112 acres in size and would be located in the southern and western portion of the Refuge, south of the core wetlands and auto tour route, and west of Camas Creek. This area includes sagebrush-steppe, willow riparian and scrub-shrub, and wetland habitat. This area includes, and overlaps with, the current south waterfowl and upland game hunt unit (1,530 acres). The Refuge would issue up to 20 refuge access permits annually to hunters within GMU 63. An any-elk (bull and antlerless) hunt would be conducted from August 1 through August 31, and an antlerless hunt would be conducted from September 1 through December 31. Fall elk hunts proposed in Alternatives 2 (Preferred Alternative) and 3 would occur within the majority of the Refuge’s palustrine scrub-shrub willow habitat (primarily the Rays Lake area). Stankowich (2008) demonstrated through results of both a literature review and meta-analyses, that environmental factors and experience with humans and their recreational activities have effects on ungulate behavior. Disturbance from the limited elk hunting opportunities proposed in Alternatives 2 and 3 would cause a decrease in the value of refuge riparian habitats as security cover for ungulates and possibly disperse some refuge moose, elk, and deer off of the Refuge from August 1 through December 31. While the proposed elk hunt would impart negative effects upon fall migratory landbirds within refuge riparian and palustrine scrub-shrub habitats, the overall impacts are expected to be minor due to the low total number of hunters and the fact that a maximum of two hunters would be allowed on the Refuge at a given time.

Conversely, the elk hunt potentially could cause minor to moderate positive effects to willow riparian and scrub-shrub habitat through reduced browsing pressure. The removal/elimination of large predators in many areas has allowed populations of some prey species, including elk, to increase. By working with IDFG to develop a refuge elk hunting program, Alternatives 2 and 3 can mimic the ecological role that large predators once served, in both removing a segment of the population and also causing disturbance and animal movement. Hunting is not a direct ecological substitute for predators, however, as predators would naturally remove the sick, weak, or injured animals, whereas hunters often target the healthiest, largest animals for removal. Yet, in the absence of large predators, hunting may provide as a source of disturbance that modifies animal use patterns. Providing some hunting pressure on the Refuge may deter elk from using the Refuge as a safe haven and disperse them onto areas open to all hunters in GMU 63. By controlling the herd size and/or dispersing the herd from the Refuge, hunting may reduce damage to refuge riparian habitat and result in improved habitat conditions for a wide suite of species.

6.6.3 Overall Effects to Riparian Habitats and Wildlife

Alternatives 2 and 3 would provide a major increase in both the quality and quantity of willow riparian habitat on the Refuge, benefitting a suite of species that depend on this habitat for breeding, migration, or thermal cover. Alternative 1 would provide minor benefits to these species through maintaining the Refuge's limited existing willow riparian habitat; however habitat quality would be expected to decline over time under this alternative. Camas Creek would remain diked and incised, and overbank flooding would continue to be a rare event. Continuation of current management would likely exacerbate the effects of a lowering water table and fuel the conversion of wetland habitat to mesic and xeric habitat types.

An emphasis on increasing riparian habitat functions, through development of a process oriented Wetland and Riparian Rehabilitation Plan (WRRP) in Alternative 2 (Preferred Alternative) and Alternative 3, would be expected to result in moderate beneficial effects to riparian habitats and associated wildlife (e.g. breeding and migratory landbirds) over the course of the fifteen-year CCP. The WRRP would address and seek solutions to the primary causes of riparian habitat degredation, for example loss of overbank flooding. Alternative 2 would have the greatest (moderate) effect to riparian habitat and associated wildlife through carefully planned restoration strategies based on up to date scientific data, making the most efficient use of water, and prioritizing limited resources to focus on wetland and riparian rehabilitation. Alternative 3 would have a moderate, but lesser positive effect than Alternative 2 because of its equal emphasis on wetland/riparian and upland management.

The strategies of Alternative 2 (Preferred Alternative) for constrained public recreational use would result in negligible negative effects to riparian habitats, while still providing ample opportunities for wildlife observation and photography. Allowing big game (elk) hunting in Alternatives 2 and 3 would convey a slight negative effect upon refuge riparian big game and migratory wildlife, which could potentially be counterbalanced by reduced browsing pressure on willows and improved habitat condition.

Overall, a minor to moderate negative effect to riparian habitat would result through continuation of current management (Alternative 1); a moderate positive effect would result for riparian habitats and associated species through implementation of Alternative 2 (Preferred Alternative); and a minor to moderate positive effect from Alternative 3.

6.7 Effects to Upland Habitats and Associated Species

Differences between alternatives in effects to upland habitat (semi-desert shrub-steppe and grassland) and associated wildlife are the result of changes in the emphasis for upland restoration, agricultural plantings (crops and haying), control of invasive species, and management of public uses (hunting, wildlife observation and photography, and environmental education and interpretation).

Sage-steppe habitats occur on 2,623 acres (24 percent) of the 10,806-acre Refuge. Of this, 471 acres are green rabbitbrush shrubland, which is considered an early seral stage of sagebrush steppe. An additional 1,113 acres which were historically likely a mixture of sage-steppe and native grassland habitat, are now classified as upland non-native vegetation, the majority of which is crested wheatgrass. Alternative 1 (Current Management) and Alternative 2 (Preferred Alternative) would rehabilitate and restore approximately 113 acres of sage-steppe habitat. An emphasis for restoring resiliency to late successional uplands would be undertaken in action Alternative 3. Alternative 3 would undertake 425 acres of habitat rehabilitation and restoration within the refuge sagebrush ecosystem.

6.7.1 Effects to Upland Habitats and Wildlife from Habitat Actions

Upland Management

Over time, more than half of the sagebrush habitat at Camas NWR has been highly degraded by altered fire regimes, livestock grazing, and invasive species. Some areas of the Refuge that once supported sagebrush habitat (984 acres) now are monocultures of crested wheatgrass, with minimal value to wildlife. However, some areas of high quality habitat remain, that are far superior to any shrub habitat on adjacent private land. Efforts to stabilize and rehabilitate upland habitats (sage-steppe and native grassland) would increase in Alternative 3 in comparison to Alternative 1 (Current Management) and Alternative 2 (Preferred Alternative). In Alternative 2 (Preferred Alternative) the Refuge would undertake sage-steppe restoration, but the emphasis on upland habitats would be lower priority and subordinate to wetland management. In Alternative 2, the Refuge would not dismiss opportunities for large-scale efforts to restore habitat connectivity, function, and processes (as described in Alternative 3), but wetland and riparian rehabilitation would remain the management priority. Therefore, large-scale upland habitat management would occur only as additional funding and time allows. In Alternative 3, management of upland habitats (sage-steppe and native grassland) would receive equivalent emphasis with wetland and riparian management. The Refuge would emphasize restoring landscape connectivity within sagebrush ecosystems to support and maintain integrated wildlife communities.

Under all alternatives we would use a suite of strategies (physical, mechanical, and chemical treatments) to attain desired vegetative conditions on either existing or restored upland habitats. In all alternatives we would use various methods to suppress crested wheatgrass in order to establish sagebrush and enhance these areas for wildlife. The methods selected would be based on the most current scientific literature and knowledge (Pehrson and Sowell 2011). In all alternatives, increasing plant diversity in grass monocultures would lead to improved habitat, greater species richness and community diversity, improved aesthetics, more soil cover (Stevens 1994), and increased diversity of birds, mammals, reptiles, and insects (Reynolds 1980).

Alternative 1 would rely on a "passive" approach to, maintaining and protecting existing uplands through invasive species containment and limiting access. In some cases previous protective and passive restrictions (for example, removing livestock from the Refuge in 1994) have greatly enhanced upland habitats, facilitated regeneration in previously disturbed areas, and minimized the need for active management. While the "passive" approach of Alternative 1 would maintain existing refuge sagebrush communities that are highly resistant and resilient (Wisdom et al. 2005; see Chapter 2), and at low risk for transitioning to undesirable states, it is highly unlikely that small refinements in current management practices will maintain existing, desirable conditions in areas where sagebrush communities have low resistance and resiliency (Hemstrom et al. 2002).

Before undertaking broad restorative sage-steppe efforts, Alternatives 2 and 3 would initiate inventories to determine which sagebrush communities are currently resistant and resilient, versus those that have low resistance and resilience, as well as those with characteristics intermediate to these extremes (Wisdom et al. 2005). Many sagebrush communities that have intermediate levels of resistance and resiliency require restoration and management, as identified in Alternatives 2 and 3, to prevent undesirable transitions that are likely to occur under current management (Alternative 1). In some areas, areas past grazing has impacted sagebrush shrub habitat to the point where transitional thresholds were reached and degraded habitats are now dominated by late successional sagebrush with little grass or forb understory. These areas are now at risk from catastrophic wildfire and conversion to an annual cheatgrass state. Active restoration (as proposed in Alternatives 2 and 3) would be required to restore these altered habitats. Alternative 3 would require more active management to attain restoration objectives, entailing more cost than Alternatives 1 (Current Management) and 2 (Preferred Alternative).

Preventing undesirable transitions across thresholds is a high priority in Alternative 3, and would require comprehensive and effective management of all anthropogenic disturbances that operate at broader scales in the sagebrush ecosystem. However, the funds needed to fully implement all prescriptions on regional sagebrush ecosystems are scarce, and considerations of current natural resource management budgets makes implementation of Alternative 3 difficult at best (Wisdom et al. 2005). Due to refuge budget and resource constraints, Alternative 2 would apply the concept of “triage” according to a system of priorities designed to maximize habitat function (Wisdom et al. 2005). Under this alternative, occupied sage-grouse habitat which has moderate or high potential to be maintained would be prioritized for management. This would concentrate management where populations of sagebrush focal species are largest and declining least (Connelly et al. 2004). Alternative 2 would therefore result in a higher cost to benefit ratio than Alternative 3, and be more achievable in the long term.

Refuge participation in Land Protection Planning would occur in all alternatives. Under all alternatives, a Preliminary Project Proposal (PPP) would be developed within three years of CCP completion. If the PPP by the USFWS Director is approved, a more detailed Land Protection Planning (LPP) process would then be initiated to address large-scale land protection alternatives and help to prioritize adjoining lands that are most critical for protection of refuge water quality and quantity; have the highest quality sage-steppe and wetland habitat; and provide the best opportunities for habitat restoration. This approach would cultivate working relationships with county, State, and Federal agencies to stay abreast of current and potential developments, and would use outreach and education as needed to raise awareness of refuge resources and dependence on the local environment.

Wetland and Riparian Management

Until more natural hydrologic processes can be reinstated, encroaching upland shrubs in wet meadow habitat would be removed under Alternatives 2 and 3. However wetland and riparian management would have a neutral effect on native sagebrush-steppe and semidesert grassland sites.

Fire Management

Under all alternatives, the Refuge would control wildfires in sagebrush steppe habitat. Wildlife Urban Interface (WUI) burns would be initiated when needed to protect off-refuge lands from a wildfire originating on a refuge. WUI burns are typically conducted in Meadow Grass and Shrub Habitat types, but can occur in any habitat type that could potentially threaten private residences. In many cases, homes or personal property immediately abuts refuge lands. If a fire were to start on the Refuge and carry through to these private residences, the Refuge may be held liable. Wildlife habitat on the Refuge is typically denser than vegetation on adjacent private lands, thus there is more fuel to carry a fire. This may result in a more intense fire by the time it reaches the refuge boundary. To counteract this problem, a blackline, or area where all vegetation and fuel has been removed with fire, can be created along the refuge boundary, adjacent to areas where private property could be at risk. These blacklines are typically 50-100 feet in width and are intended to protect private land, not to enhance wildlife habitat.

Alternatives 2 and 3 include preventative physical, mechanical and chemical treatments to reduce fuel loads and reduce the risk of catastrophic wildfires in sagebrush-steppe habitat. Prescribed fire may be used to reduce fuel loads, but would not be implemented unless strategies are in place to reduce risk of post fire invasion by nonnative plants. The use of prescribed fire would be restricted to less than 120 acres or 20% of sage-grouse habitat within a 20-30 year fire return interval. In concert with other habitat management strategies, this would be expected to provide minor positive benefits to sagebrush-steppe habitat.

Invasive Species Management

Under all alternatives, mechanical, cultural, chemical, and biological weed control methods would be evaluated in accordance with the refuge IPM plan (Appendix F). Chemical usage will be subject to provisions of the IPM plan. Potential effects to the biological and physical environment associated with the proposed site-, time-, and target-specific use of pesticides (Pesticide Use Proposals [PUPs]) on refuge lands would be evaluated using scientific information and analyses documented in "Chemical Profiles" (see Appendix F). Chemical profiles provide quantitative assessment/screening tools and threshold values to evaluate potential effects to species groups (birds, mammals, and fish) and environmental quality (water, soil, and air).

PUPs (including appropriate Best Management Practices) would be approved where the Chemical Profiles provide scientific evidence that potential impacts to refuge biological resources and its physical environment are likely to be only minor, temporary, or localized in nature. Along with the selective use of pesticides, PUPs would also describe other appropriate IPM strategies (biological, physical, mechanical, and cultural methods) to eradicate, control, or contain pest species in order to achieve resource management objectives.

Based on scientific information and analyses documented in "Chemical Profiles" (see Appendix F), most pesticides allowed for use on refuge lands would be of relatively low risk to non-target organisms as a result of low toxicity or short-term persistence in the environment. Thus, potential impacts to refuge resources and neighboring natural resources from pesticide applications would be expected to be minor, temporary, or localized in nature under all alternatives.

Agricultural Crops

In all alternatives, the Refuge would provide supplemental crops for migratory waterfowl and sandhill cranes using the Snake River migratory corridor. Current Management (Alternative 1) and Alternative 2 (Preferred Alternative) would cooperatively farm about 140 acres of irrigated alfalfa and 20 acres of irrigated small grain. This would not only benefit waterfowl, but also upland game birds and big game species that inhabit the Refuge. Under Alternative 2 alfalfa plantings would be reduced by 20-40 acres (to 100-120 acres) if the Refuge loses its cooperative farmer for the Well #9 field and cannot acquire irrigation equipment; however dryland grain would increase by 20-40 acres annually. Alternative 3 would reduce agricultural plantings of small grains and alfalfa from 160 acres to 80 acres (60 of irrigated alfalfa and 20 acres of irrigated small grain), and 80 acres of farmland in the Well #9 field would be slowly restored back to a native sage-steppe community. Over the fifteen-year CCP, the increase in sagebrush habitat restored under Alternative 3 would constitute a minor positive increase in available sage-steppe habitats for sagebrush facultative and obligate species. Decreased migratory bird population fitness would not be anticipated to occur due to the small reduction in agricultural crops in Alternative 3; however, the Refuge may experience increased depredation complaints at times from private landowners due to a reduction in agricultural refuge practices.

Refuge alfalfa supports an abundant small mammal community that is often exploited by various birds of prey. Swainson's hawks will hunt for mice and voles in alfalfa which provides a long-term, stable habitat for prey and good hunting conditions year round (Estep 1989). The optimal time for Swainson's hawks to use alfalfa is when prey is easily accessible, especially after a cutting or irrigation and when field vegetation is less than 15 inches tall (Swolgaard et al. 2008). Swainson's hawks rely heavily on the current agriculture landscape in southeast Idaho to provide adequate hunting grounds and safe nesting sites along riparian corridors. Compared to Alternatives 1 and 2, Alternative 3 provides less benefit to Swainson's hawks due to a reduction in prime foraging habitat.

However, frequent early alfalfa cutting on private lands changes the amount and structure of vegetation used by many birds for nesting and also destroys nests and eggs of ground nesting birds. (CPIF 2000; Frawley and Best 1991). Because the Refuge limits alfalfa harvests to late summer, refuge alfalfa operations will not impact birds that select alfalfa fields as nest sites.

Establishing and maintaining alfalfa crops on refuge sage-steppe habitats would require the most cost and oversight in Alternatives 1 and 2, which farm 140 acres of alfalfa versus the 60 acres in Alternative 3. In all alternatives, a combination of agricultural best management practices, including crop rotation, mowing, plowing and disking of agricultural fields will be timed to reduce the need for pesticides and fertilizers while ensuring adequate alfalfa production for wildlife. Timing of alfalfa plantings would be based on the types of weeds present. In Alternatives 2 and 3, winter wheat or rye plantings would be used as companion crops with legumes because they release chemicals that suppress the development of weeds, reducing the need for pesticide use. Because of the aggressive nature of some weed species, they can become established despite preventive efforts. Therefore in all alternatives, approved refuge herbicide treatments might be necessary to combat some weed problems in agricultural fields.

Agricultural Haying

Alternatives 1 (No Action) and 2 (Preferred) would both hay 150 irrigated acres annually. In Alternative 3, the Refuge would not irrigate hay fields, and hay 150 dryland acres annually. As noted in Section 6.3.1 above, haying during the first two weeks of July can cause disturbance and direct mortality to ground nesting birds, small mammals, reptiles, and amphibians. In all alternatives, Refuge haying would not be allowed to begin until after July 15, minimizing impacts to ground nesting birds. However minor impacts would be expected to species that raise multiple broods. However, this effect would be minor given the relatively small acreage and limited distribution of hayed habitat on the Refuge.

Habitat fragmentation from human land-uses, such as haying, tends to increase the amount of edge adjacent to uplands (Laurance and Yensen 1991), thus subjecting upland wildlife populations to new or increased ecological interactions (e.g., predation, parasitism) associated with these edges (Wilcove et al. 1986). The prevailing principle of wildlife management is that increased edge and fragmentation of habitat negatively affect numerous species of nesting birds by increasing depredation or parasitism rates of nests (Paton 1994). Several specific studies report elevated rates of nest predation in fragmented forested and wetland landscapes (Donovan et al. 1997; Hartley and Hunter 1998; Robinson et al. 1995) and in small habitat remnants (Small and Hunter 1988; Wilcove 1985). Again, this effect would be minor given the relatively small acreage and limited distribution of hayed habitat on the Refuge.

Alternative 2 (Preferred Alternative) would continue to hay 150 acres and reseed current hay meadows, currently non-native quack and brome grass, to a more palatable and desirable mix of grasses for foraging and nesting wildlife. Alternative 2 would therefore improve the composition of upland grassland habitats for a suite of nesting and foraging wildlife (Bishop and Vrtiska 2008; Fefer 1977; Jarvis and Harris 1971).

6.7.2 Effects to Upland Habitats and Wildlife from Public Recreational Use

As noted in Section 6.5.2 above, under all alternatives, public use is expected to increase over time as a result of increasing regional populations, increasing demand for wildlife-dependent recreation, and a greater awareness of the Refuge. Increasing visitation would cause greater impacts in Alternative 1 than in Alternatives 2 and 3, in part because of the more dispersed nature of recreation in Alternative 1, and because Alternatives 2 and 3 provide for additional staffing and facilities to manage visitor use. However, enhanced public use facilities and visitor service programs under Alternatives 2 and 3 could draw additional visitors over the baseline increase expected due to population increases and general recreation trends. In general, the highest number of visitors is anticipated for Alternative 3, because this Alternative would result in the highest number of facilities and program offerings.

As visitation increases, there will be the potential for a degree of additional trampling of native upland habitats from off-trail usage as well as some additional disturbance to upland species. However, these negative effects (explored in more detail in the Compatibility Determinations—see Appendix B) are considered relatively minor except around and near concentration areas such as kiosks/viewing sites or trails.

As noted in Sections 6.3.2 and 6.5.2 above, anticipated direct impacts of wildlife observation and photography, interpretation, and environmental education include disturbance to wildlife by human presence which typically results in a temporary displacement of individuals or groups. In all alternatives use of the auto tour route, service and hunter access roads, trails, and associated facilities provides potential avenues for human disturbance of wildlife and habitat on the Refuge. The auto tour route primarily skirts the edges of wetland habitat, while service roads (which would remain open to hiking, bicycling, cross country skiing, and snowshoeing in all alternatives) primarily run through upland habitat.

Miller et al. (1998) found that the trail zone of influence for forest and grassland birds appears to be approximately 75-100 m (246-328 feet). Beyond this distance, bird abundance, species composition, and nest predation was not affected by even heavily used recreational trails. Linear effects from trail and roadway disturbance would be slightly greater, overall, in Alternative 3 than in Alternatives 1 and 2. Total roads open to vehicular traffic are 12.8 miles in Alternatives 1 and 2 (6.3-mile Auto Tour Route, open year round; 6.5 miles of hunter access roads open during the hunt season) while Alternative 3 has an additional 7.5 miles of roads seasonally open to vehicular traffic due to the re-opening of the Sandhole Lake loop road (July 1-Nov 1). Both Alternative 2 (Preferred Alternative) and Alternative 1 (Current Management) would reduce wildlife disturbance due to vehicular traffic by continuing to provide only 6.5 miles of seasonally available roads for wildlife observation and photography, while keeping the Sandhole Lake loop road closed to vehicle travel. Disturbance due to pedestrian and bicycle traffic on the Refuge's 27 miles of service roads would be the same in all alternatives. Currently, the use of these roads for hiking, bicycling, cross-country skiing, and snowshoeing is low and therefore, disturbance would be expected to be infrequent and short-lived. We expect that in the near future most public use would continue to occur on the Auto Tour Route and 1.3 mile birding trail, while visitor use of service roads, which mostly run through upland habitats, would remain low. Grooming of 10 miles of service roads for cross-country skiing under Alternative 3 may result in an increase in this use; however, this use would have a relatively small impact since it is limited to roadways and occurs after the breeding season for all forms of wildlife.

A number of species show greater reactions when pedestrian use occurred off trail (Miller et al. 1998; Taylor and Knight 2003). Alternative 1 (Current Management) offers the greatest public recreational access, with the entire 10,806-acre Refuge open to off-road hiking from July 15-February 28. Alternative 3 restricts off-road hiking to 2,510 acres (the north and south waterfowl hunting units). Alternative 2 would not allow off-road hiking to occur anywhere or anytime on the Refuge. Of the three alternatives, Alternative 2 (Preferred Alternative) offers the most restrictive access and opportunity for wildlife observation and photography, but the most positive benefit to refuge wildlife by minimizing wildlife disturbance through restricting public access to roads and trails (except for hunters pursuing game in the hunt areas). In addition, Alternatives 2 and 3 would restrict dog walking to roads and require short leashes or electronic collars. Currently dogs can accompany owners off trail from July 15-February 28, and regulations allow off leash dogs if they are under "close control." Overall, Alternative 1 would result in the greatest (minor to moderate) impacts to upland habitat and wildlife; Alternative 2 would have the lowest impact; and Alternative 3 would be intermediate between the two, but still minor.

Effects to Elk and Other Ungulates from Elk Hunting Program

Currently big game hunting is prohibited on the Refuge (Alternative 1, Current Management). Under Alternatives 2 and 3 we propose to allow elk hunting on 4,112 acres of the Refuge, in line with Idaho GMU 53 seasons and regulations. A maximum of 20 elk hunting permits would be issued annually, and a maximum of 2 elk hunters would be allowed on the Refuge at any given time.

The first elk sighting documented on the Refuge was that of two elk in September 1937, near Rays Lake. Until the 1990s elk sightings were sporadic, ranging from one to four animals every five to ten years. The first year that elk were documented in a group larger than four animals was 1994, when 27 animals were reported. Using monthly surveys in 2008-2009 and other recent general observations, we estimate that the Refuge holds up to 150 elk at any one time in the fall and winter, when numbers are typically highest. The bulk of the elk spend their time south of the auto tour route, primarily in willow riparian habitat around Rays Lake. Some of these elk may be a resident herd, while other elk use the area solely as a wintering ground. It has been speculated that elk come into GMU 63 from two directions: from the Beaverhead Range, across Highway 22, and from the Island Park area, crossing Interstate 15.

Typically refuges work with states to provide quality big game hunts in-line with state objectives and in consideration of herd health, and undue disturbance from concentrated hunting pressure.
The Draft Idaho Elk Management Plan 2014-2024 (IDFG 2013) does not specify a numeric population objective for elk in the Snake River Zone. IDFG's proposed 10-year management direction for the Snake River Zone is as follows: "Management direction in the Snake River Zone

involves decreasing the current elk population. The zone is dominated by agricultural lands and small communities that are not compatible with large numbers of resident elk. It is proposed to continue managing for minimal elk numbers by using long, liberal hunting seasons and prompt responses to crop and property damage on agricultural lands" (IDFG 2013).

For the past fifteen years or so this unit has had one of Idaho's longest and most liberal (five months long) elk hunting seasons. Between 2006 and 2011 harvest in the unit has ranged from 70 in 2011 to 257 in 2010. In the proposed hunt up to 20 Refuge permits would be issued to harvest elk annually, and we assume that not all hunts will be successful. Therefore the Camas hunt would represent only a fraction of the total harvest in the GMU 63 and would not result in significant cumulative impacts to elk populations regionally or statewide. Nevertheless, an increase in harvest in GMU 63 would help reduce the local population to levels that are socially acceptable, by reducing direct financial losses to farmers. As reproductive cows are removed from the local population during the antlerless hunt, it is assumed that the Camas NWR elk hunt may assist IDFG in achieving its desired population reduction in the Snake River Zone. Direct reductions in population through hunting, combined with lower reproductive rates, could contribute to a decline in long-term herd productivity in GMU 63. However this would be in line with the IDFG's elk management objective for the Snake River Zone, including GMU 63, which is to reduce the current population through long, liberal hunting seasons and response to crop and property damage.

Disturbance effects of elk hunting to upland wildlife

Wildlife may respond to hunter activity in Alternatives 2 and 3 in a variety of ways, depending on the range of variables associated with the activity. Examples of such variables include type, distance, direction of movement, speed, predictability, frequency, magnitude, and location of the activity (Knight and Cole 1995a). Wildlife disturbance can precipitate behavioral changes, such as avoidance, habituation, or attraction (Knight and Temple 1995). Disturbance of wildlife species that habituate to human use tends to be greater when recreational activities occur away from established use areas such as parking areas and trails (Cole 2004; Gutzwiller et al. 1994; Gutzwiller and Marcum 1997; MacArthur et al. 1982; Riffell et al. 1996). Conversely, disturbance effects may be somewhat minimized by establishing designated sites and routes for visitor activities in relation to such species (except for habituation, which is a disturbance response, and which would be exacerbated in established use areas). Physiological responses can include the "fight or flight" response, with elevated heart and respiratory rates, or the "freeze" response, with inhibition of activity and reduced heart and respiratory rates. The implications of disturbance are often heightened during sensitive life stages, such as breeding, overwintering and rearing of dependent young. Depending on the disturbance variables listed above, the long-term effects on individual animals can be altered behavior, reduced vigor, lower reproductive success, and/or death (Knight and Cole 1995a).

The elk hunt proposed in Alternatives 2 (Preferred Alternative) and 3 can exert a variety of effects on both targeted and non-targeted ungulates. Most big game ungulates either run or hide in response to hunting pressure. If animals successfully elude hunters by running, the energetic cost may deplete fat reserves needed for survival during winter in temperate regions. If animals successfully elude hunters by hiding, there may be an energetic cost from lost foraging opportunities. Most studies of ungulate responses to hunting have focused on changes in habitat selection. Ungulates typically respond to hunting by seeking areas of security (Edge and Marcum 1985; Irwin and Peek 1979; Knight 1980; Millspaugh et al. 2000; Naugle et al. 1997), by altering activity patterns (Naugle et al. 1997), by adjusting home ranges (Kufield et al. 1988; Root et al. 1988) or by moving long distances (Conner et al. 2001; Vieira et al. 2003). In the general sense, elk respond to disturbance by fleeing; whereas, deer eluded hunters by hiding (Johnson et al. 2005). However, the difficulty of monitoring hunter density and elk and deer populations on large landscapes has prevented the collection of sufficient data to develop models of energetic costs associated with hunting or with other recreational activities. Variation in weather, hunter density, herd dynamics and seasonal conditions can likely bring about changes in the interactions between hunters and animals, making generalizations tenuous at best.

Quantitative relationships between levels of hunting pressure and energy expenditure can be used to evaluate potential secondary effects of activities on nutritional condition of ungulates. For instance, frequent hunter disturbance from elk hunt in Alternatives 2 and 3 could result in high energy expenditure by ungulates adversely affecting animal weight dynamics in winter, when forage is scarce, or in summer, when energy requirements are high for lactation and rebuilding body mass following winter (Cook et al. 2004). During hunting seasons, disturbance increases energetic costs for elk (Johnson et al. 2005). Elk within GMU 63 may incur higher energy costs due to hunter disturbance from the proposed elk hunt on Camas NWR, as the Refuge would cease to serve as a sanctuary from human disturbance and hunting pressure. This could indirectly lead to reduced body condition and reproductive fitness, as elk may deplete stored fat reserves to avoid hunters and forage on more remote and less secure BLM rangelands. It is unlikely, however, that the proposed hunt would increase winter mortality since this is not a limiting factor of the GMU 63 elk herd (Schmidt 2013).

6.7.3 Overall Effects to Upland Habitats and Wildlife

In summary, the use of the specified habitat management techniques is expected to improve the composition and structure of the upland plant communities. Minor, temporary, localized disturbance and damage could occur as a result of using these habitat management techniques, but these effects would be temporary and shortly eclipsed by enhanced habitat structure and composition. Considering the total acres managed together with the intensiveness of strategies proposed, Alternative 3 presents the option that may result in the highest quality of upland habitat, but would entail high cost and limit advancements in wetland and riparian rehabilitation. Alternative 2 presents the option that may ultimately result in a minor positive direct improvement in sagebrush-steppe habitat, but would better balance limited refuge resources (staff and finances) for attainment of refuge management objectives for wetland and riparian rehabilitation. Alternative 1 would maintain existing high quality sagebrush-steppe habitat but would not reverse transitions to undesirable states in habitat that is less resistant and resilient.

Overall, Alternative 1 would result in the greatest (minor to moderate) negative impacts to upland habitat and wildlife due to public use, primarily due to allowing free roam hiking throughout the Refuge. Alternative 2 would have the lowest impact, primarily due to eliminating free-roam hiking. Impacts of Alternative 3 would be intermediate that of Alternative 1 and 2, primarily due to elk hunting and opening the Sandhole Lake loop to vehicular traffic, but still minor. Overall, a minor positive effect would occur for upland sage-steppe associated species under Alternatives 1 and 2 and a moderate positive effect from Alternative 3.

6.8 Effects to Shelterbelt Habitats and Associated Species

Only 34 acres (less than 1 percent) of the total 10,806-acre Refuge is shelterbelt habitat. The tall canopy trees are Plains cottonwoods planted as windbreaks when the Refuge was commissioned in 1937, and the shorter sub-canopy trees and shrubs are predominantly native coyote (narrowleaf) willow, and non-native Russian olive and Siberian pea. However, this small area is extremely important to migratory landbirds. Carlisle et al. (2008) documented an impressive abundance and diversity of spring and autumn migrants using the headquarters shelterbelt, and showed that birds were gaining mass during stop-over (see Chapter 4).

6.8.1 Effects to Shelterbelt Habitats and Wildlife from Habitat Actions

Shelterbelt Management

In all alternatives, existing naturalized shelterbelt habitat would continue to be maintained to provide habitat quality stop-over habitat for migratory landbirds and maintain quality wildlife viewing and photography opportunities. In all alternatives, the Refuge would continue to replace large cottonwoods lost from mortality and replace non-native understory trees and shrubs (e.g., Russian olive, Siberian pea) with native understory components. Differences between alternatives in their effects to shelterbelt habitat and associated wildlife are the result of differences in the area and rate of replanting, irrigation systems, invasive species control, and public uses (wildlife observation and photography, interpretation, and environmental education). Hunting does not occur within the Refuge's shelterbelt.

Under Alternative 1 (Current Management) we would continue to irrigate cottonwood trees using groundwater, and replace mature trees near the end of their life-span. Annually, 5-10 percent of the cottonwood overstory and understory of non-native shelterbelt trees and shrubs would be replaced with species that are native to Idaho. Replacement of trees and shrubs has been initiated in some areas and is proving to be time, labor, and money intensive. With the lowering of the water table, must be irrigated for several years, until their root systems are well established. Alternative 1 uses surface water diversions and groundwater pumping to surface irrigate shelterbelt habitats. While surface irrigation is appropriate in areas with sandy soils (Letey 1985; Sijali 2001) only half of applied water actually reaches Refuge plantings because of inefficient irrigation infrastructure.

Alternative 2 (Preferred Alternative) would manage shelterbelt habitats within the current 34-acre footprint, but would increase efforts to replace mature cottonwoods from 5-10 percent of the overstory to 10-15 percent annually. The rate of non-native understory plantings would be reduced from 5-10 percent to 1-5 percent annually. However, additional supplemental funding sources would need to be secured to implement Alternative 2, since the Refuge would not use refuge base funds to replace tall mature cottonwood trees or native understory trees and shrubs. Refuge soils are predominantly sandy and therefore flood irrigation is a highly inefficient use of water due to rapid drainage. Therefore, Alternative 2 (Preferred Alternative) would use a combination of partial groundwater irrigation and a highly efficient micro-drip irrigation system (Griggs 2009) to provide water to newly established shelterbelt plantings within the current footprint. Drip irrigation makes it possible to place water precisely where and when needed with a high degree of uniformity and efficiency (90 percent or more). Losses to runoff, deep percolation and evaporation are minimal (Sijali 2001) and most of the irrigation water is taken up by the plant. The use of drip irrigation would therefore greatly enhance survival of tree plantings, while simultaneously conserving water.

Although this system would entail a high initial cost, it would result in water conservation and cost savings in the long term.

In Alternative 3, non-native understory trees and shrubs replacement would be vastly accelerated. The Refuge would dramatically increase cottonwood overstory rehabilitation from 5-10 percent in Alternative 1, to 20-25 percent annually in Alternative 3. Non-native understory replacement with natives would correspondingly increase as well, from 5-10 percent in Alternative 1, to 10-20 percent in Alternative 3. As in Alternative 1, a combination of surface water diversions and groundwater pumping would be used to surface irrigate shelterbelt habitats, reducing mortality of mature trees and increasing survivability of planted trees. The Refuge would use both base and outside funding sources to expand this habitat by 36 acres to 50 acres (a 40 percent increase).

Several factors influence bird abundance and species diversity in shelterbelts, including distance from nearest shelterbelt, patch size, width (number of rows), and vegetative structure, complexity, and species composition (Cassel and Wiehe 1980, Hudson 2000, Martin 1981, Martin and Vohs 1978, Yahner 1983). In general increasing bird abundance and species diversity is associated with increasing patch size, width, and complexity. Strategies within Alternative 1 (Current Management) and Alternative 2 (Preferred Alternative) would improve structural complexity within the shelterbelt canopy and understory habitats. However the greatest positive effect for migratory landbirds would occur in Alternative 3, which would not only replant structural components lost to mortality within the current shelterbelt area (34 acres), but increase the size of the headquarters shelterbelt by 15 acres from Alternatives 1 and 2, increasing the amount of this habitat on the Refuge by 40 percent.

While bird use of shelterbelts may be affected by the isolation of the belts or by the presence of barriers to dispersal between belts, the effects of these factors were minimal in Martin's (1981) study of South Dakota shelterbelts, suggesting that isolation or dispersal were insignificant factors. No CCP alternative would attempt to create an additional shelterbelt habitat site other than the one established at the refuge headquarters. Effects to abundance and diversity are anticipated to be negligible to migratory landbirds, since the current, and relatively long mean distance between shelterbelt stands would be maintained.

At Camas NWR, non-native species such as Russian olive and Siberian pea provide much of the cover available to migrants during stop-over. The fact that the majority of refuge migrants were able to gain mass during stop-over at Camas NWR within mixed native/non-native vegetation suggests that, either in spite of or with the help of non-native vegetation, migrants are able to stop-over successfully in these oases (Carlisle et al. 2008). Hudson (2000) found that species richness of fall migrant landbirds was greatest in willow but that short distance migrants such as yellow-rumped warbler and white-crowned sparrow were more common in Russian olive. These data stress the importance of native riparian habitats but also suggest that Russian olive habitats can be important to certain migrant species. Therefore the systematic long-term approach of Alternative 2, to gradually restore 1-5 percent of the non-native vegetation per year with native trees and shrubs, versus the more rapid approaches proposed in Alternatives 1 and 3, is not only warranted but likely to result in positive effects to migratory landbirds.

Assuming continued habitat restoration occurs at Camas NWR in Alternative 2, and/or there is sufficient interest, the Refuge would also resume mist netting to measure response of landbirds to restoration efforts. Three consecutive years of monitoring would allow us to account for annual fluctuations in analyses. Monitoring would allow the Refuge to employ adaptive management and better ensure that shelterbelt management is benefitting migratory landbirds.

Invasive Species Management

Russian olive was promoted as an excellent species for windbreaks, erosion control, and wildlife enhancement as early as 1939 (Van Dersal 1939) and planted as such at Camas NWR. Russian olive was one of the very few medium-height trees that were commercially available for use in dryland windbreaks and shelterbelts up until the 1970s. Many agencies recommended landowners use Russian olive and Siberian pea for conservation plantings in cropland environments that required trees and shrubs that tolerated arid to semi-arid conditions. Some of the same agencies that promoted it years ago are now spending large amounts of time and money to control it. In all alternatives, refuge riparian areas will be revegetated with native species in order to maximize habitat function.

The first documentation of Russian olive escaping cultivation occurred in 1924 in Utah, and by 1954 it had escaped cultivation in all adjoining states (Christiansen 1963; Knopf and Olsen 1984). It has been especially invasive in wet-saline riparian environments. Russian olive is not listed on the Federal Noxious Weed List or the Idaho Noxious Weed List. New Mexico and Colorado are the only states currently listing it as legally noxious. Utah has also listed it as a noxious weed in several counties.

Brown (1990) compared native willow sites to Russian olive sites along the Snake River in Idaho. Willow sites had higher species richness and density, and more foraging and nesting guilds of birds than Russian-olive sites. Brown implicated a lower abundance of insects in Russian olive sites as the cause of negative effects on avian communities. Therefore, the shift from native to exotic dominated riparian habitats may result in regional loss of avifaunal diversity. Knopf and Olson (1984) compared wildlife use of stands dominated by Russian-olive versus use in adjacent native riparian communities in Colorado and Utah. They observed 505 individuals of 56 species in native riparian vegetation, and 458 individuals of 40 species in Russian-olive. Clearly, avian species richness and diversity is lower in Russian-olive stands than in native riparian vegetation. Although Russian-olive provides food and cover for many species, it negatively impacts cavity-nesting birds (Olson and Knopf 1986). Lesica and Miles' (1999) study conducted in north-central Montana showed limited use of Russian-olive by beaver. Beavers prefer cottonwoods (*Populus* spp.), (Lesica and Miles 1999), quaking aspen (*P. tremuloides*), and willow (*Salix* spp). Lesica and Miles proposed that this preference might accelerate the replacement of cottonwood by Russian olive.

Reduction of top growth and containment of spread is usually practiced in areas where Russian olive infestations are large and eradication is cost prohibitive. Complete eradication of Russian olive is frequently impractical. However, eradication is practical for small isolated stands, such as Camas NWR, where the total cost of control and time investment is manageable. Strategies for non-native shelterbelt understory control or eradication will include a variety of IPM techniques in all alternatives, and will include: mowing; cutting; girdling; flooding; chemical; shading; burning; tillage; biocontrol; chaining; and dozing (Stannard et al. 2002).

If substantial disturbance to wet riparian sites occur during the removal of woody debris, stumps, and roots, the site should be seeded with well-adapted herbaceous species to reduce weed invasion. If the disturbance is minimal, it may be possible to plant tree and shrub seedlings directly. Russian olive is less likely to become invasive on dry upland sites. It is well adapted to this environment and local recruitment is minimal, however, dryland plantings may serve as a seed source for more vulnerable sites during flood events (Stannard et al. 2002). While in all alternatives it is necessary to remove Russian olive trees from windbreak and shelterbelt systems and replace them with more desirable species, each alternative takes a different approach to the timeline for achieving replacement of non-native Russian olive and Siberian pea. Depending on the design of the windbreak, wildlife values may decrease dramatically in Alternative 3, with up to 20 percent of the understory being replaced annually, until the replacement trees reach a functional size. In Alternative 2 the replacement of non-native trees within the understory would occur at a reduced rate (1-5 percent annually), to allow replacement growth to reach a medium-sized component (~15 to 20 feet in height) within the shelterbelt understory before too much of larger understory of non-native trees are removed.

People can be vectors for invasive plants by moving seeds or other propagules from one area to another. Once established, invasive plants can out-compete native plants, thereby altering habitats and indirectly impacting wildlife. In all alternatives the threat of invasive plant establishment from refuge and recreational activities will always be an issue requiring annual monitoring and treatment when necessary. Refuge staff will continue work at eradicating invasive plants and educating the visiting public about the impacts these species have on shelterbelt and other refuge habitats.

6.8.2 Effects to Shelterbelt Habitats and Wildlife from Public Recreational Use

Eastern Idaho birders have recognized the wooded area at Camas NWR as a migration hotspot for decades. Increased birding attention in the past decade has yielded numerous sightings of birds never previously documented in Idaho in addition to impressive numbers of more common species. For these reasons, the CCP is attempting to address the means for Camas NWR to simultaneously provide migrant bird habitat, while serving as a high quality recreational and educational opportunity for people across the region.

Alternative 2 (Preferred Alternative) and Alternative 3 would increase public recreational infrastructure and opportunities for wildlife observation and photography through the construction of the visitor contact station, kiosks, wildlife observation platform, expansion of the current half-mile birding trail to 1.3 miles, and increased refuge tours. Alternative 3 also includes the construction of three semipermanent photo blinds. Construction of the birding trail near refuge headquarters was initiated about five years ago. Currently the birding tail is only about one half mile long and does not have a defined or complete loop. Under Alternatives 2 and 3, a 1.3 mile loop would be completed that takes visitors through the best landbird habitat the Camas NWR has to offer. The expanded birding trail in Alternatives 2 and 3 would occur within and/or run parallel to shelterbelt adjacent to the headquarters and visitor kiosk and parking area. Dog walking would be prohibited on this trail under Alternatives 2 and 3.

As noted in Section 6.3.2 above, negative impacts have been shown to arise when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Response of wildlife to human activities includes: departure from site, use of suboptimal habitat, altered behavior (Burger 1981; Klein 1993; Morton et al. 1989), and increase in energy expenditure (Belanger and Bedard 1990; Morton et al. 1989). Gutzwiller et al. (1997) found that singing behavior of some songbirds was altered by low levels of human intrusion. Pedestrian travel can impact normal behavioral activities, including feeding, reproductive, and social behavior.

Resource managers should be aware of responses by the avian community to small, incremental changes in recreation use. Miller et al. (1998) found that nesting success of landbirds was lower near recreational trails than at greater distances from the trails; and that species composition and abundance was influenced by trails (the zone of influence was as high as 100m for some forest species). Croonquist and Brooks (1993) noted that bird species richness and abundance generally decreased with distance from disturbed segments of habitat, but remained relatively constant through the reference watershed. At disturbed sites most neotropical migrant birds with specific habitat requirements were recorded only during migration. Available surface water is an important habitat attribute for some species, and an impoverished bird community with tolerance to disturbance can exist in the vicinity of water with less than 10 m (30 feet) of natural riparian or shelterbelt vegetation; however, sensitive species will not occur unless an undisturbed corridor greater than 25 m (82 feet) in width is present. Presence of narrow 2 m (7 feet) bands of woody vegetation along riparian corridors and fence rows seemed to be important in maintaining portions of the bird community in disturbed areas (Croonquist and Brooks 1993).

Roosting bald eagles use refuge shelterbelts extensively during the winter season. The response of bald eagles to human activities is variable. Reported responses have included spatial avoidance of activity and reproductive failure (Anthony et al. 1995; Buehler et al. 1991; Hamann et al. 1999; McGarigal et al. 1991; Watson 1993), although in some cases, eagles tolerate human disturbances (Harmata and Oakleaf 1992). Public use of refuge roads and recreational trails has the potential to cause disturbance to wintering bald eagles (Skagen et al. 1991; Stalmaster and Newman 1978). Bald eagles seem to be more sensitive to humans afoot than to vehicular traffic (Grubb and King 1991; Hamann et al. 1999; Skagen et al. 1991; Stalmaster and Newman 1978). Fletcher et al. (1999) reported that the abundance of bald eagles was lower in riparian habitats with nonmotorized trails compared to riparian habitats without trails. However, no model has been developed for assessing the cumulative effects of linear recreation routes on bald eagle habitats. Wildlife photography, observation, interpretation, and environmental education, when compatible, are wildlife-dependent recreational activities, and when compatible, considered priority public uses for the National Wildlife Refuge System. Disturbance to shelterbelt migratory birds from wildlife observation along the birding trail is expected cause a moderate negative effect to understory nesting and foraging birds within 100m of the trail, and a minor negative effect to birds that carry-out life history events in the more secure overstory of the mature cottonwoods. The prohibition of off road hiking on all (Alt 2) or most (Alt 3) of the Refuge, and limiting the use of portable photo blinds to within 100 feet of roads, and no more than five total blinds on the Refuge at any given time, would likely reduce levels of disturbance to migratory birds in shelterbelt habitats. Overall, disturbance to birds that use shelterbelt habitat in the Preferred Alternative (Alternative 2) and Alternative 3 would be minor, because there is a sufficient amount of undisturbed shelterbelt available to refuge wildlife for foraging, and escape and breeding cover.

6.8.3 Overall Effects to Shelterbelt Habitats and Wildlife

In all alternatives tall cottonwood trees lost to mortality would be replaced and native understory trees and shrubs would be used to replace non-native understory. However Alternative 1 and Alternative 3 would not wait to develop supplemental funding sources to support shelterbelt management and would provide more immediate benefits that Alternative 2 (Preferred Alternative). Alternative 3 would provide additional shelterbelt habitats and a moderate positive benefit to associated wildlife (neo-tropical migrant landbirds), but at a much increased management cost to the Refuge. Water conservation strategies within Alternative 2 would not only make the most efficient application of refuge water resources of all the alternatives, but would also increase survivability of shelterbelt plantings.

Disturbance to shelterbelt wildlife due to wildlife observation and photography would continue to occur in all alternatives, due to public interest in rare Idaho bird occurrences within the refuge shelterbelts. However, negative effects to breeding birds and neo-tropical migrants that use shelterbelt habitats are expected to be less (minor) in Alternatives 2 and 3 due to the prohibition of off road hiking on all (Alt 2) or most (Alt 3) of the Refuge, and limiting the use of portable photo blinds to within 100 feet of roads.

6.9 Effects to Soil Resources

Soil is formed as a product of the continual interactions among the biotic (faunal and floral), climatic (atmospheric and hydrologic), topographic, and geologic features of the environment over long periods (Jenny 1941; Singer and Munns 1996). Soils are important components of refuge ecosystem sustainability because they supply air and water, nutrients, and mechanical support for the sustenance of plants.

Refuge operations have the potential to affect soil resources as a result of contamination, compaction, and erosion from wetland, upland, riparian, fire, and agricultural management.

6.9.1 Effects to Soil Resources from Habitat Actions

Wetland Management

Wetland soils of Camas NWR consist of very deep, very poorly drained soils on old lakebeds. Before ground and surface water alterations occurred from irrigators, these soils were inundated between May and October. Levelton clay loam, Medano sandy loam, and small areas of Psammaquents constitute most of the wetland soil complex. The Medano soil is in the slightly elevated areas adjacent to areas of Psammaquents. The Psammaquents are in the depressional areas and were frequently covered with water when overbank flooding of Camas Creel and artisanal groundwater discharges occurred. Included within Psammaquents are small areas of Fluvaquents, typically occurring on nearly level sites and are erratically stratified and variable.

Permeability of the Medano wetland soils is moderately rapid. Effective rooting depth is 60 inches or more. Available water capacity is moderate. Surface runoff is ponded or very slow, and the hazard of erosion is slight. The water table is at a depth of 0 to 2 feet during April through June. Psammaquents are very deep, sandy, and very poorly drained. They formed in alluvial outwash. They consist of marsh areas that are usually inundated between May and October.

In all alternatives, the Refuge would use heavy equipment in wetlands and uplands to accomplish various habitat management practices. On uplands, heavy equipment would generally be used only during the dry season. In wetlands, heavy equipment would be used only after the wetland has been drained.

Indicators of soil quality are listed in Table 6.3. Mechanical tillage of emergent cattail and bulrush often leaves wetland soils bare for portions of the year, which negatively affects soil quality indicators (Nelson et al. 2006), such as aggregate stability, infiltration rates, and available water capacity. Compaction can result from the use of heavy equipment, causing undesirable increases in bulk density while tilling may also prevent the accumulation or accelerate the decomposition of organic matter and can diminish earthworm populations (USDA NRCS 2012).

Table 6.3. Soil Quality Indicators

Indicator	Relationship to Soil Health
Soil Organic Matter (SOM)	Soil fertility, structure, stability, nutrient retention; soil erosion
Physical: soil structure, depth of soil, infiltration and bulk density; water holding capacity	Retention and transport of water and nutrients; habitat for microbes; estimate of crop productivity potential; compaction, plow pan, water movement; porosity; workability
Chemical: pH; electrical conductivity; extractable N-P-K	Biological and chemical activity thresholds; plant and microbial activity thresholds; plant available nutrients and potential for N and P loss
Biological: microbial biomass C and N; potentially mineralizable N; soil respiration.	Microbial catalytic potential and repository for C and N; soil productivity and N supplying potential; microbial activity measure

Source: USDA NRCS 2012.

In all alternatives, some minor impacts to soil quality are likely to occur due to the use of heavy equipment. Soils would experience some ground disturbance from tillage, mowing, or fire for site preparation in areas restored to native habitats in Alternatives 2 and 3. Compaction could produce temporary impacts to soil quality, such as reduced water infiltration, and some loss of soil organic matter, but over time, these areas would likely undergo a positive trend toward more stable ground cover, increased organic matter, and increased soil health.

Biological resources cannot be successfully managed without knowledge of the underlying abiotic resources upon which they ultimately depend and inhabit. The preferred alternative would provide a realistic timeline to complete and implement a wetland rehabilitation plan within the lifetime of the CCP. Local-scale knowledge of soils, hydrography, topography, and geomorphology would be of primary interest to the Refuge as it collects and synthesizes information to initiate a Wetland and Riparian Restoration Plan by 2017. Alternatives 2 and 3 would spend the first three years of the CCP collecting necessary information (geomorphological, hydrological, and biological assessments). Under Alternatives 2 and 3, the Refuge would provide a foundation for abiotic ecosystem components, such as soils, to guide refuge management into the future.

Upland Management

Grassy Butte loamy sand makes up about 60 percent of the upland soils complex, and Medano loamy sand makes up 20 percent. The Grassy Butte soil is in the higher lying areas on dunes, and the Medano soil is in concave and depressional areas. The Grassy Butte soil is deep and somewhat excessively drained. It formed in sandy eolian deposits. Permeability of the Grassy Butte soil is rapid. Effective rooting depth is 60 inches or more. Available water capacity is low. Surface runoff is very slow or slow, and the hazard of erosion is slight. The hazard of soil blowing is very high.

Upland restoration and rehabilitation practices will occur in all alternatives, but in greater magnitude in Alternative 3, when compared to Alternatives 1 and 2. Under all alternatives rehabilitation treatments (e.g., herbicides, tilling, brush cutting, prescribed fire) will coincide with restorative interseeding or out-planting practices to increase herbaceous and shrub establishment in treated areas and reduce the occurrence of soil erosion. To reduce non-native grasses the Refuge will inter-seed native grasses and forbs with a minimal till drill (e.g., Truax or Brillion). Minimal till drills substantially reduce soil disturbances that would result from the option of using a deep-furrow rangeland drill in highly erodible Grassy Butte soils.

Riparian Management

Under both the Preferred Alternative (Alternative 2) and Alternative 3 the Refuge would develop and implement a Riparian and Wetland Rehabilitation Plan. In the implementation phase (2017-2027) we would rehabilitate Camas Creek to at least partially restore natural geomorphic forms and processes and create a sustainable fluvial ecosystem. Restoration of geomorphic form, however, does not necessarily restore geomorphic process, such as soil erosion, transport, and deposition. Still, implementation of Alternatives 2 and 3 has the potential to create moderate positive effects to the conservation of riparian soil resources.

Fire Management

In all alternatives, prescribed fire would be used as a management tool in wetlands and occasionally uplands. Fire does not necessarily result in decreases in soil nitrogen (MacDougall and Turkington 2007). When conducted properly, prescribed burning can result in faster nutrient recycling to soils. In some cases, prescribed fires can burn hot enough to scorch the top layers of soils, which can negatively affect water infiltration. In general, the only occurrences of such hot fires exist under burn piles created from woody vegetation disposal piles. The Refuge mitigates the effects by hot burns on burn piles by mixing soils after the burn and by reusing burn pile areas in subsequent years. Fire prescriptions would avoid overly hot fires that can scorch soils, and given the lightness of the fuel in these habitats, overly hot fires are unlikely.

Wind erosion of soil can be extreme following fires in the northern Snake River Plain. In all alternatives, increased wind erosion is expected to occur following fall or spring prescribed fires, especially in areas also affected by previous grazing practices (Vermeire et al. 2005), and at various intervals following summer wildfire (Whicker et al. 2002; Zobeck et al. 1989). Prescribed fire to reduce emergent cover in wetlands must be timed carefully to limit wind erosion. Either wetlands must be reflooded immediately following fire, or late fall burns should be timed with snowfall to limit soil exposure.

Agricultural Crops

Agricultural practices in Alternatives 1, 2, and 3 would include disking fields (prior to seeding), seeding in fall (spring seeding may be used for perennial crops), and tilling. Under current management, crop residues are generally removed by fall tilling, but some fields are left fallow over the next summer.

In Alternatives 2 and 3 we would implement a conservation tillage system that plants with the slope rather than up and down a slope and avoiding fall tillage for spring plantings. This would improve soil retention, reduce fertilizer costs, and reduce erosion. Planting field border strips around refuge small grain fields, as proposed in Alternative 2, would reduce erosion in end rows, reduce non-point source pollutants and sediments, improve water quality, and provide an element of safety for machinery operations (Haufler 2007). Among the benefits of the rotational practices proposed by the

Refuge in Alternatives 2 and 3 are higher soil organic matter and nitrogen, lower fossil energy inputs, yields similar to those of conventional systems, and conservation of soil moisture and water resources, which is especially advantageous under drought conditions (Pimentel et al. 2005).

In all alternatives the Refuge will amend soils with lime and appropriate fertilizers. Liming can be an effective method of reducing soil acidity in alfalfa fields. Alfalfa requires high levels of phosphorus and potassium and soil pH in the 6.6 to 7.2 range to ensure nutrient availability (Dionne et al. 1989; Rechcigl et al. 1986; Tsakelidou 2000). Studies suggest that surface liming can ameliorate subsoil acidity fifteen to seventeen years after application, and that surface liming provides a good strategy to combat subsoil acidity (Dolling and Porter 1994; Tang et al. 2003). Soil testing proposed in Alternatives 2 and 3 would ensure that lime is added as needed to maintain soil pH at optimal levels, ensuring maximum nutrient availability and reducing the need for fertilizers. Soil tests would also be used to determine nutrient deficiencies and needs for small grain production. While nitrogen application almost universally increases cereal yield in all precipitation zones on soils with low available soil N (Schillinger 2006), excessive nitrogen can intensify S deficiency and decrease yield under severe S deficiency (Rasmussen and Douglas 1992). Should soil testing indicate a need for lime or fertilization, the Refuge and the cooperative farmer would work together to decide on the best strategies to achieve desired soil conditions.

Most local commercial growers prefer to apply anhydrous ammonia or urea-ammonium-nitrate solution in combination with P fertilizers in a tillage operation prior to planting grain crops. However, in Alternatives 2 and 3 the Refuge would not allow cooperative farmers to apply anhydrous ammonia fertilizers in order to minimize excessive environmental N accumulations. Accumulation of anhydrous ammonia fertilizers can lead to soil and water acidification, contamination of surface and groundwater resources, increased ozone depletion and increased greenhouse gas levels associated with the production of these highly reactive enhanced N fertilizers (Motavalli et al. 2008). Therefore, Alternatives 2 and 3 would result in better soil health in comparison to Alternative 1, by reducing soil acidification.

Agricultural Haying

Soil compaction is the reduction of soil volume due to external factors; this reduction lowers soil productivity and environmental quality. Haying operations in wet soil types are noted to cause greater impacts to soil compaction and vegetation damage than on drier upland sites (Gilley et al 1996). Gilley et al. (1996) further documented that soil roughness was significantly greater and bulk density significantly less on undisturbed long-term idle sites than hayed areas. The relatively large bulk densities measured on the hay fields imply that considerable compaction occurs at or near the soil surface from those operations (Murphy et al. 2004). Recent trends for increased size and use of tractors and agricultural machinery has additionally increased the probability of soil compaction during farm operations (Martel and MacKenzie 1980). Soil compaction by machinery has an indirect effect on soil invertebrates. Some earthworms can burrow into compacted soil (Joschko et al. 1989) but others have their activity restricted by compaction under conditions of high water (Kretzschmar 1991). Soil compaction has also been shown to decrease slug populations (Ferguson et al. 1988). Rabotnov (1974) found a decrease in proportion of soil geophytic grass in Russia, which could be partially explained by soil compaction as a result of hay collection.

Alternative 3 (Preferred Alternative) would eliminate haying in wet or moist meadows, where equipment may adversely impact vegetation and soil. Only dryland haying would be conducted. Additionally, haying occurs on the Refuge in mid-August and early September, some of the driest months of the year. To further minimize soil compaction or damage in Alternative 2, fields that have been saturated by rain would not be hayed until soil conditions can support the required haying equipment. Since the Preferred Alternative (Alternative 2) calls for haying to occur in a drier time of the year for warm-season grasses on well-drained soil types, impacts from soil compaction would be decreased in comparison to Alternative 1 (Murphy et al. 2004).

6.9.2 Overall Effects to Soil Resources

Overall reduction in haying and agricultural practices in Alternative 3 would produce the strongest trend toward increased soil health, with a moderately beneficial effect on refuge soil resources. Alternative 2 (Preferred Alternative) would create a minor beneficial effect for refuge soil resources from agricultural best management practices, riparian restoration, and haying reductions, while Alternative 1 would have a minor beneficial effect for refuge soil resources from agricultural best management practices.

6.10 Effects to Water Resources and Water Quality

Refuge operations have the potential to affect water quality stemming from pollutants, sediment, or elevated water temperatures.

6.10.1 Effects to Water Quality from Habitat Actions

Wetland Management

Camas NWR wetlands were historically flooded by artesian groundwater discharges, but are currently dependent upon continued groundwater pumping to maintain wetlands through the summer. In Alternative 1 (Current Management) the main refuge point of diversion from Camas Creek remains in its original location and only one groundwater well has been moved since the original drilling of the seven irrigation wells. From this main diversion point on Camas Creek, water must flow 2 miles in order to reach the first managed wetland basin in Alternative 1, resulting in losses to seepage and evapotranspiration. Alternatives 2 and 3 would target wetlands with tighter pockets of natural hydric soils for management as permanent and semipermanent water regimes. Therefore, Camas NWR wetlands are anticipated to hold water longer and make more efficient use of refuge resources and water under Alternatives 2 and 3. We would no longer attempt to maintain late season wetlands in basins with porous soils. By moving the main point of diversion and irrigation wells downstream closer to the wetlands, as proposed in Alternatives 2 and 3, losses to evapotranspitation and seepage would be reduced, and the Refuge would make more efficient application of limited water resources.

In all alternatives, the wetlands of Camas NWR would continue to remove some portion of Total Suspended Solids (TSS) and Total Phosphorous (TP) from Camas Creek prior to entering Mud Lake. However Camas Creek sediment and phosphorus would continue to accumulate in refuge wetlands. An emphasis and management approach for increasing shallow ephemeral refuge wetlands in Alternatives 2 (Preferred Alternative) and 3 may increase TP and TSS in the Mud Lake, but only slightly less than Alternative 1 (Current Management).

Upland Management

The ambient water quality of the regional aquifer is considered to be very good because of its large volume and high recharge rate (Jehn 1989). Locally however, it is vulnerable to contamination. The porous and permeable nature of the aquifer layers, and the discontinuous overlying soils, provide little opportunity for filtration, sorption or other attenuating effects on upland pollutants (IDWR 1998). The Eastern Snake River Plain Aquifer is also a sole source of drinking water for many of the 400,000 people living in the basin, and was designated by the Environmental Protection Agency as a Sole Source Aquifer in 1991 (U.S. EPA 1991).

The Refuge would comply with Service policies in all alternatives regarding pollution control at all of its facilities, including wildlife refuges. These policies direct all Service employees 1) to comply with all applicable environmental laws and regulations; 2) to reduce pollution; 3) to inventory and properly treat or handle any hazardous substances; and 4) to clean up or remove hazardous materials on contaminated sites. These policies are discussed in the Service's Manual in the 500 Series, which can be accessed at http://www.fws.gov/policy/manuals/.

Riparian Management

The Beaver-Camas Subbasin of southeastern Idaho is the easternmost in a series of five sinks drainages in the Upper Snake River Basin. The hydrology of the subbasin is dominated by both natural and human caused flow alterations, which contribute to limited beneficial use attainment in several 303(d) listed reaches in the watershed (IDEQ 2005).

The complex system of gaining reaches in the upper, mountainous regions, and losing reaches in the lower basalt dominated regions of the subbasin contribute to divergent stream characteristics between the upper and lower sections of the basin. As the subbasin assessment shows, natural flow losses coupled with irrigation water removal from the stream make it difficult to attain beneficial use support in select streams. Where flow limitations do not completely impede beneficial use support, IDEQ (2005) developed temperature Total Maximum Daily Loads (TMDLs) for the streams with documented exceedances in the temperature criteria.

Camas Creek is degraded, incised, and highly unstable, heavily influenced by anthropogenic modification and adjacent land use practices. Camas Creek is 303(d) listed from headwaters (Spring Creek confluence) to mouth, in two segments. The listed pollutants for the upper segment of Camas Creek are flow alteration, nutrients, and sediment. Part of this segment, above T9N, R37E, Section 16 (N44.19270°, W−111.98284°), is perennial. Sediment and temperature TMDLs have been calculated to address the pollutants of concern above this point. IDEQ (2005) determined that riparian grazing has contributed to bank erosion and elevated stream temperatures. The lower section of Camas Creek, including the reach within Camas NWR, is 303(d) listed for flow alteration, habitat alteration, sediment, nutrients, and temperature. This section of Camas Creek is intermittent and flow altered for irrigation, therefore IDEQ (2005) recommended this segment to be de-listed for sediment, nutrients, and temperature and re-listed as a flow altered reach.

Alternatives 2 and 3 would partially restore riparian function through development and implementation of the Wetland and Riparian Rehabilitation Plan (see Section 6.5 above). Riparian management would have a minor positive effect on water quality on Camas Creek. However, water quality in the creek is largely determined by factors outside the Refuge and it is likely that the lower reach of the creek would remain 303(d) listed for sediment, nutrients, and temperature.

Shelterbelt Management

As noted in Section 6.8 above, many of the tall shelterbelt trees (i.e., Plains cottonwood) around headquarters are at the end of their life span and are in need of replacement. Replacement in some areas has been initiated and is proving to be time, labor and money intensive. In Alternative 3, shelterbelt habitats would be expanded to 50 acres, a 15 acre increase from Alternative 1 (Current Management). In both Alternatives 1 and 3, groundwater would continue to be used to irrigate shelterbelt habitats. Alternative 2 (Preferred Alternative) would be a compromise between providing important neotropical migrant bird habitat, and conserving refuge water resources. The Refuge would use a combination of partial groundwater irrigation and a highly efficient micro-irrigation system to provide water to newly established plantings on the same footprint (34 acres) that shelterbelt habitats currently occupy. Of the three CCP alternatives, Alternative 2 (Preferred Alternative) provides the most water efficient management for naturalized shelterbelt cottonwoods, willows, and other trees and shrubs.

Fire Management

Fires affect water quality and water cycle processes to a greater or lesser extent depending on fire severity. When a fire occurs, changes in water quality are primarily the result of soil erosion and deposition of soil materials into water (Neary et al. 2005). Fires may cause suspended sediment, elevated streamflow temperatures, increased pH values, and changed chemical concentrations and aquatic organism populations.

Severe wildfire can produce substantial effects on the streamflow regime of small streams and rivers (Neary et al. 2005). The effects of low severity prescribed fires on water resources are generally minimal and short-lived. Additionally, the Refuge would minimizes fire effects upon water quality in Alternatives 2 and 3 by restricting prescribed fire applications to over 200 m (656 feet) from riparian and wet meadow habitat.

Agricultural Crops and Haying

Agricultural practices are considered sources of pollutants in the Beaver-Camas Subbasin (IDEQ 2005). Elimination of irrigation of hay fields and reduction of alfalfa farming practices in Alternative 3, and proposed changes in agricultural practices in the Preferred Alternative (Alternative 2) would improve aquatic habitats of Camas Creek, but the lower stream reach would remain on the §303(d) list for excessive temperature, suspended solids, and nutrients (phosphorus).

Sediment and pollutant entry to streams from runoff and erosion would likely diminish under the action alternatives (Alternatives 2 and 3). This is especially true under Alternative 3, since 150 acres of hay ground and an 80 acre field used for alfalfa would be retired and restored to native habitats by 2027, with attendant reductions in water diversion and erosion. A lesser, but still moderate benefit would result for water quality under Alternative 2, with the decrease in refuge irrigation for hay production, and for alfalfa planting should we lose the cooperator for the Well #9 field.

As noted in Section 6.9 above (Effects to Soils), in Alternatives 2 and 3 the Refuge would not allow cooperative farmers to apply anhydrous ammonia fertilizers. Accumulations of these fertilizers can lead to soil and water acidification, contamination of surface and groundwater resources (Motavalli et al. 2008). Therefore, Alternatives 2 and 3 would result in improved water quality compared to Alternative 1, although the effect would be minor in the context of the Camas Creek watershed.

Invasive Species Management

The use of herbicides or pesticides to control invasive plants or animals, or to control weeds or pests in croplands, also poses several environmental risks, including drift, volatilization, and persistence in the environment, water contamination, and harmful effects to wildlife (Bossard et al. 2000). Herbicide use may diminish or remain approximately the same under Alternatives 2 and 3, because acres that would be taken out of farming and haying would require weed control to prevent unwanted invasives. For weed species that are or become established, mechanical, cultural, chemical, and biological control methods would be evaluated in accordance with the refuge IPM plan. This plan provides direction that "the most efficacious pesticide available with the least potential to degrade environmental quality (soils, surface water and groundwater) as well as least potential effect to native species … would be acceptable for use on the Refuge." Each approved pesticide would undergo a chemical profile analysis; active ingredients would be analyzed for their risk quotient and this value compared to a Level of Concern for surrogate species, as established by the EPA.

Although there are a large number of acres on the Refuge potentially subjected to herbicide treatment in the Proposed Action Alternative (Alternative 2), the potential for negative impacts to water quality are considered minimal due to the types of herbicides used (non-persistent), the limited number of acres that would be exposed in riparian habitat, and the precautionary measures taken during application (Appendix F).

6.10.2 Overall Effects to Water Quality

Overall, Alternatives 2 and 3 would be expected to result in a minor beneficial effect to water quality, compared to Alternative 1, based on expected changes in potential pollutants entering streams or the groundwater table within the Refuge. However, the lower reach of Camas Creek is likely to remain 303(d) listed for sediments, nutrients, and temperature.

6.11 Effects to Air Quality

Air quality over the Refuge is occasionally subject to temporary, localized negative impacts. These arise primarily from prescribed burning for habitat management purposes. In addition, dust is generated locally from traffic during the dry season on unpaved refuge roads and from tilling or haying of agricultural fields.

6.11.1 Effects to Air Quality from Habitat Actions

Wetland and Upland Management

During refuge prescribed fires, smoke may be present in increased quantities in the local area during limited periods of time. In comparison to Alternatives 2 (Preferred Alternative) and 3, continuation of current management (Alternative 1) would need to rely upon prescribed burning more frequently. Proposed management within Alternative 1 relies on a more predictive and static hydroperiod in wetlands, therefore the density and distribution of shallow bulrush and cattail communities would increase and require additional physical or mechanical disturbance to reduce its dominance within the wetland community. Prescribed fire would be used more frequently in willow riparian communities under Alternatives 2 and 3, and would continue to be used infrequently in upland communities under all alternatives. These would be expected to result in minor negative effects to local air quality in all alternatives.

Fire Management

According to Service Clean Air Act directives, “Our policy is to protect and enhance the quality of the Nation’s air resources to promote the conservation of fish and wildlife resources, and to protect the public health and welfare and the productive capacity of populations. In order to accomplish this, we will comply with all applicable Federal, interstate, State, regional, and local air quality regulations” (561 FW 2, Clean Air Act 2.2). In addition, the prescribed fire management directive states: “Visibility is a major consideration in smoke management. Your planning for prescribed fire must include the potential for hazardous situations, including impaired visibility created by smoke both on and off our lands. You must meet the provisions of the Clean Air Act and the State Implementation Plan (SIP)” (621 FW 3, Prescribed Fire Management 3.4).

Acceptance of refuge decisions to use prescribed fire and tolerance of short-term impacts to air quality by local residents sometimes depend on the areal extent of the treatment, the degree of planning that precedes implementation, the adequacy of the resources (human, equipment, and fiscal) available to the managing agency, and the proximity of the fuel treatment to developed areas (Winter et al. 2002). In all alternatives, the Service will work with the local communities and minimize adverse air quality impacts through participation in the Montana/Idaho Airshed Group. The group members include Federal, Tribal, State, and private land managers in Idaho and Montana. The intent of the Airshed Group smoke management program is to minimize or prevent smoke impacts while using fire to accomplish land management objectives.

The combustion products (smoke) from wildfires or prescribed burns can affect visibility and the quality of life of smoke-sensitive individuals, including those with respiratory ailments such as asthma (Winter et al. 2002). These impacts can be minimized by proper timing and preparation for burning (Brunson and Kruger 1996). Under all alternatives, the Southeast Idaho NWRC Fire Management Officer submits a list of planned burn projects to the Smoke Management Unit (SMU) in Missoula, Montana via internet. This information creates a database describing the type of burn, fuel type and loading, number of acres in each unit, legal location and elevation. Each burn unit is assigned an identification number. The day before the planned ignition, the burn boss accesses the SMU internet database to submit a proposed prescribed burn for the following day.

The SMU meteorologist then develops a daily smoke dispersion forecast by airshed and posts to the SMU website. The SMU Smoke Management Program Coordinator develops daily burn unit recommendations during spring and fall and posts to the SMU website. In addition the Idaho Department of Environmental Quality may review the dispersion forecast and burn proposals daily and relay any issues or concerns to the SMU.

The SMU issues daily decisions which can recommend against burning when atmospheric conditions are not conducive to good smoke dispersion. Restrictions may be directed by airshed, elevation or by special impact zones around populated areas. The burn boss would access the daily decision notice from the SMU via the internet the day before planned ignition. In all alternatives, prescribed burn projects will only be conducted when the SMU does not post a burning restriction for the airshed in which the Refuge is located.

No non-attainment areas are located in or near the Refuge and specific smoke sensitive areas area identified in individual burn plans and appropriate mitigation measures have been identified for all alternatives.

Agricultural Crops

Tilling of agricultural fields would decrease in Alternative 3, compared to Alternatives 1 and 2. In Alternative 3 agricultural plantings on the Refuge would occur on 80 acres in comparison to 160 acres in Alternatives 1 and 2.

Dust is particulate matter (PM) consisting of very small liquid and solid particles. Fugitive dust is PM suspended in the air primarily from soil that has been disturbed by wind or human activities, such as earthmoving and vehicular/equipment traffic on unpaved surfaces (IDEQ 2011). Due to the small size and weight of particulate matter (10 micrometers or less in diameter, compared to 70 micrometers for the average human hair), it can remain airborne for weeks. When inhaled, it can travel easily to deep parts of the lungs and may remain there, causing respiratory illness, lung damage, and even premature death in sensitive individuals (IDEQ 2011).

The Environmental Protection Agency (EPA) guidance for estimating PM emissions from agricultural crop tilling involves combining a constant emission factor with county-level activity data, including the silt content of surface soils, the number of tillings performed in a year for each crop type, and the acres of each crop type (EPA 2001, 2004). The Idaho Department of Environmental Quality (IDEQ) is responsible for regulating fugitive dust emissions in Idaho. Authority is based on the Rules for the Control of Air Pollution in Idaho (IDAPA 58.01.01, Section 651), which require that all “reasonable precautions” be taken to prevent particulate matter from becoming airborne. While no PM emissions data exist for Southeastern Idaho, it is estimated that the refuge contribution to PM emissions would not significantly improve local or regional air quality in Alternative 2 or 3. Under all alternatives the Refuge follows IDEQ guidance to minimize the surface area disturbed, reduce public speed limits, limit dusty work on windy days, and supply dust suppression measures when needed. In all alternatives, fugitive dust problems from proposed refuge activities are anticipated to be negligible to local or regional air quality standards.

6.11.2 Effects to Air Quality from Public Recreational Use

Under all alternatives, we would expect a slight increase in PM emissions due to increased public visitation and additional traffic on local and refuge roads. The Refuge would experience increases in visitation over the fifteen-year time horizon of the CCP under all alternatives, due to a combination of increasing local population and increase in recreation demand. There would likely be a minor increase in visitation under Alternatives 2 and 3 over this baseline, due to increased public use staffing and facilities. A minor increase in vehicular visitation may occur in Alternative 3 due to re-opening the Sandhole loop road and increased refuge guided tours. Anticipated auto tour traffic is not anticipated to exceed 60 vehicles per day or 400 vehicles per month in Alternatives 2 and 3. This increase is small compared to Alternative 1 and would cause negligible effects local air quality.

6.11.3 Overall Effects to Air Quality

Alternatives 1, 2, and 3 would be expected to have a negligible to minor negative effect on local air quality. Impacts of prescribed fire would be short-term and localized, and minimized by proper timing and preparation of burns in coordination with the Missoula, Montana Smoke Management Unit (SMU).

6.12 Social Effects—General

Welcoming visitors and providing opportunities for visitors to enjoy wildlife-dependent public uses, such as wildlife observation, interpretation, wildlife photography, hunting, and environmental education, is an important part of the NWRS mission.

6.12.1 Effects from New Facilities

Alternative 2 would entail a moderate increase in new facilities and infrastructure to accommodate projected increases in demand for wildlife-dependent recreation. These would include a small visitor contact station; updated informational panels at the headquarters kiosk; lengthening the current half-mile long birding trail to 1.3 miles; and an observation platform on Camas Creek. The visitor contact station would house an environmental education multi-purpose room and refuge offices. Exact dimensions and locations for new facilities would be determined at the site design stage prior to construction. The Refuge would pursue funding for the purchase, leasing, or construction of these facilities.

Alternative 3 (Preferred Alternative) includes all facilities identified in Alternative 2, with the additional maintenance of the 7.5-mile Sandhole loop road for vehicular access, and construction of three semipermanent photo blinds for wildlife photography.

New facilities and infrastructure under Alternatives 2 and 3 would be expected to result in irretrievable loss of approximately 2 acres of habitat over the Refuge as a whole. About 1.5 acres of habitat loss in each action alternative is associated with the construction of the new office and visitor contact facility on Camas NWR.

6.12.2 Projected User Numbers in Fifteen Years

In order to assess the social effects of the alternatives, it is important to understand the broader context of the Refuge within the region and how recreational demand and public use is expected to change over time. The 2010 census (U.S. Census Bureau 2010) reported a 21.1 percent increase in Idaho’s population. In addition, Jefferson, Bonneville and Madison counties, including the Idaho Falls MSA (Metropolitan Statistical Area) have been experiencing rapid growth between 2002 and 2012. During this period, Jefferson County was the second fastest growing county in the state (Idaho Department of Labor 2013a). Bonneville County grew 25 percent (from 85,060 to 106,684 in 2012, while Madison County’s population increased 32 percent. Over the last decade Madison County was the fourth fastest growing county in the state (Idaho Department of Labor 2013b, c). The growing Idaho population coupled with an increasing interest in nature-based recreation and tourism within the State would be expected to increase visitation to Camas NWR under all management alternatives. A growing visitor presence on the Refuge can be expected in the future (Table 6.4). Many of the public use opportunities currently provided at the Refuge are very popular within the State, and are forecast to attract new participants in the coming years.

Idaho Department of Parks and Recreation (IDPR) began tracking outdoor recreation trends in 2002 and published their information in the Idaho Statewide Comprehensive Outdoor Recreation and

Tourism Plan (Idaho SCORP) for 2003-2006 (IDPR 2006). Their most recent survey data from 2006 and 2010 (Idaho SCORP) show that since 2002, trends are emerging that are likely to influence visitation and use at Camas NWR, including increased demands for the following activities: outdoor photography (+44 percent), bird watching (+29 percent), snowshoeing (+28 percent), walking for exercise (+22 percent), watching wildlife other than fish (+21 percent), and cross-country skiing (+15 percent). Other noteworthy changes include a 22 percent decrease in running. Of the Idahoans surveyed in 2005, 70 percent participated in outdoor photography, with more than half described as regular participants or enthusiasts. This increase was attributed in part to the affordability and ease of digital photography.

The 2002 Idaho Outdoor Recreation Survey established baseline information for Idaho outdoor recreation trends (IDPR 2002). IDPR considered the trends from the National Survey on Recreation and the Environment (NSRE) as well as how these national rates of participation compared to Idaho's population. IDPR noted in the 2002 Idaho Outdoor Recreation Demand Assessment that Idahoans participate more than the rest of the nation in wildlife activities, particularly hunting. Idahoans are four times more likely to hunt big game and six times more likely to hunt waterfowl than the national average.

Almost 13 percent of Idahoans surveyed in 2004 participate in waterfowl hunting, 37 percent in big game hunting with rifles, and about 27 percent in small game hunting. Region 6 (Upper Snake) participation rates for waterfowl hunting were estimated to be 15.5 percent of those surveyed and ranked second of the six regions in Idaho. On average 37.3 percent of adult Idahoans participated in big game hunting, with 37.9 percent of Region 6 sportsmen and women identifying themselves as big-game hunters, ranking the Region third of the six Idaho regions in big game hunting participants. Results for small-game hunting was similar to the State average of 26.5 percent, with 24.5 percent of Region 6 adults identifying themselves as upland or small game hunters.

Cordell (2008) described general trends in nature-based recreation on National Forests, comparing data from the NSRE in 2000 and 2007. Six of the top seventeen fastest growing activities involved viewing, photographing, identifying, visiting or otherwise observing elements of nature. Viewing and photographing increased most dramatically at 78 percent and 60 percent respectively. He also noted that visitation at national wildlife refuges grew from 33 million in 1998 to over 40 million in 2007, an increase of 21 percent. Conversely, Cordell noted a decline in migratory bird hunting by 10 to 20 percent.

The 2000-2004 NSRE described the following rates of participation by activity for Idahoans surveyed: 77 percent view or photograph natural scenery, 64.7 percent view or photograph other wildlife, 57.8 percent view or photograph wildflowers and trees, and 40.9 percent view or photograph birds.

The 2002 Idaho Outdoor Recreation Survey showed higher Region 6 participation than the State averages for cross-country skiing (Region 6: 26.9 percent; Idaho: 16.6 percent); canoeing (Region 6: 22.8 percent; Idaho 18.9 percent); walking for exercise (Region 6: 80.7 percent; Idaho 78.4 percent); hiking (Region 6: 63.4 percent; Idaho 59.5 percent); watching wildlife (Region 6: 66.6 percent; Idaho 63 percent). Participation in outdoor photography in Region 6 (47.6 percent) was almost identical to the State average of 47.5 percent. In 2002 Region 6 adult participation in bird watching (45.5 percent) was second lowest, which averaged 46.5 percent participation statewide.

Table 6.4. Camas NWR's Projected Annual Visitation in Fifteen Years

Recreational Activity	Average Visitation* (2007-2012)	Current Visitation* (2012)	Projected Change from 2012 (%)	Projected Visitation (2025)
Wildlife Observation			+25	
Auto	5,083	6,100		7,625
Foot	921	1,200		1,500
Photography	600	1,000	+25	1,250
Environmental Education	181	500		
Hunting Total		18		
Waterfowl/other migratory birds		11	+8	12
Upland		7	+8	8

*Figures from 2007 onward are more accurate than previous years due to installation of a traffic counter on the entrance road.
** From 2012 Refuge Annual Performance Plan database. Projected change is an estimate based in part on the 1999 models for the Rocky Mountain Region published in Bowker et al. 1999, as described in IDPR 2002, and Idaho SCORP data from 2006-2010 (IDPR 2010).

6.13 Effects to Opportunities for Quality Wildlife Observation, Photography, Interpretation, and Environmental Education

6.13.1 Effects from Habitat Actions

Alternatives 2 and 3 both increase native habitats relative to Alternative 1. The result of these changes would generally be positive, as the increasing availability and connectivity of wetlands, riparian habitat, and uplands would likely result in enhanced opportunities to observe a variety of native wildlife in fifteen years. There may be some negative short-term effects to the visitor experience as habitat restoration work is undertaken in wetland and riparian habitats, but these are expected to be temporary and minor.

Wetland Management

When compared to Alternative 1 (Current Management) both the Preferred Alternative (Alternative 2) and Alternative 3 would provide decreased deep emergent wetland habitat (285 acres of core wetlands managed as hemi-marsh versus 783 acres currently), but increased shallow wetlands, seasonally flooded shallow wetlands (moist soil units), and wet meadows for migratory waterbird breeding and foraging habitats. 150-200 acres of moist soil units would be provided in Alternatives 2 and 3 compared to 40-60 acres in Alternative 1. 140-200 acres of wet meadow habitat associated with Camas Creek and 80-100 additional acres of wet meadow would be restored under Alternatives 2 and 3, an approximately 11-15 percent increase in total wet meadow habitat compared to current management.

Alternative 1 would provide increased “consistency” in available habitats for wildlife viewing. However, stable water regimes, which provide site “consistency” to public recreation interests, lead to long-term declines in wetland ecosystem function (Fredrickson and Reid 1990; Weller 1999).

Alternatives 2 and 3 would substantially increase the integrity and quality of wetland habitats by mimicking natural variability and dynamic ecosystem processes (e.g., drought, flood, fire). Therefore reliable wildlife observation may not be consistently available at wetland sites, or some areas may not hold high concentrations of wildlife in years when water level management is mimicking extreme drought or flood scenarios. While dynamic wetland management proposed in Alternatives 2 and 3 would cause “irregularity” in wetland habitats on a site-by-site basis in the short term, it would increase productivity and observational opportunity of the refuge marsh habitats in the long term (Fredrickson and Reid 1990; Hammer and Kadlec 1986; Middleton 2002; Reid 1989).

Upland Management

Alternative 3 would provide the most substantial long-term improvements to wildlife observation and viewing opportunities for upland wildlife. In this alternative the Refuge would not only work to restore refuge uplands, but emphasize restoring landscape connectivity within sagebrush ecosystems to support and maintain integrated wildlife communities. In Alternative 3, upland management would strongly emphasize maintaining and restoring structural and functional attributes of sage-steppe habitat, thereby increasing wildlife observation and photography opportunities for upland species, both on and off the Refuge.

Alternative 2 (Preferred Alternative) takes a more conservative approach than Alternative 3. In comparison to Alternative 1, Alternative 2 increases efforts to stabilize and rehabilitate upland habitats, but this would be a lower priority and subordinate to the primary refuge emphasis for wetland and riparian management. Large-scale upland habitat management would occur only as additional funding and time allows and would provide a negligible difference in wildlife viewing opportunities when compared to Alternative 1.

Riparian Management

The riparian zone is a bridge between Camas Creek and upland habitats. Its combination of high moisture, rich soils, and diverse vegetation makes it an exceptionally productive area for wildlife. Because riparian zones have more habitat niches than any other refuge plant community, they support not only a greater abundance of wildlife, but a greater variety as well. Riparian systems may attract up to 10.6 times the number of migratory birds found in surrounding upland sites in the spring (Stevens et al. 1977) and fourteen times the number of species recorded during fall migration (Hehnke and Stone 1979).

Alternatives 2 and 3 would increase efforts to restore the Refuge’s willow riparian habitat along Camas Creek. These alternatives attempt to restore up to 100-150 acres of native willow woodlands associated with Camas Creek, while managing suitable areas for increased recruitment and regeneration of existing willow habitat. This represents a 250-750 percent increase in willow riparian habitat along Camas Creek compared to Alternative 1 (Current Management). This would be expected to result in increased species diversity and abundance and therefore, moderately positive effect to quality wildlife observation and photography opportunities.

Shelterbelt Management

A study by Carlisle (2008) found that abundance and diversity of migratory landbirds was quite high in the Refuge's shelterbelt and riparian woodlands, and the Refuge is a well-known destination for local birders. Non-native species such as Russian olive and Siberian pea provide much of the cover available to migrant birds during stop-over and the use and importance of the non-native understory has been documented (Carlisle 2008). Although Russian olive does provide food and cover for many species, it can negatively reduce larger structured native habitat from developing and decrease available habitat for cavity-nesting birds (Olson and Knopf 1986).

In all alternatives, the Refuge would continue to replace large cottonwoods lost from mortality and replace non-native understory trees and shrubs (e.g., Russian olive, Siberian pea) with native understory components. The rate at which overstory and understory vegetation is rehabilitated is different by Alternative. Under Alternative 2 (Preferred Alternative) we would replace 1-5 percent of the non-native vegetation per year with native trees and shrub. This would have only minor negative short-term effects and moderate long-term positive benefits to quality wildlife observation and photography opportunities. Alternatives 1 and 3 would undertake a more accelerated effort to the restoration of shelterbelt understory, annually replacing 5-10 percent and 10-20 percent respectively of the non-native components. Disturbance from restoration activities and rapid changes in understory composition and structure in the fast-tracked approach of Alternatives 1 and 3 would have a moderate negative short-term (one to ten years) effect to the quality of the wildlife observation and photography experience. However, the long-term (over 10 years) positive benefits to observation and photography would be the same as Alternative 2.

Agricultural Crops and Haying

In all alternatives the Refuge would farm 20 acres of irrigated small grain crops. Refuge small grain production, and a corresponding change in wildlife observation opportunities from wildlife use of refuge crops, would not change by alternative.

Alternative 2 (Preferred Alternative) would maintain the current 140 acres of alfalfa plantings unless the cooperative farmer should cease operations, in which case 80-100 acres of alfalfa would be planted. Alternative 3 would reduce refuge alfalfa plantings to 60 acres. Reductions in alfalfa plantings in the action alternatives are expected to have only a minor negative effect on the quality of wildlife observation and photography on the Refuge; however, certain species that preferentially forage in alfalfa (e.g. Swainson's hawk, white faced ibis) may become less abundant.

Alternative 2 would provide the same hayed acres as Current Management (Alternative 1) and therefore, the same degree of quality wildlife observation and photography experiences. Irrigated haying would be discontinued under Alternative 3, thereby causing a minor negative impact to observational opportunities for species that readily forage in short cover grasslands (e.g., greater sandhill crane, Canada goose, long-billed curlew, white-faced ibis, Franklin's gull).

6.13.2 Effects from Management of Non-Consumptive Public Recreational Use

As noted in Section 6.12.2, a growing visitor presence on the Refuge can be expected in the future. Many of the public use opportunities currently provided at the Refuge, particularly birding and photography, are very popular within the State, and are forecasted to attract increasing amounts of participants in the coming years.

Wildlife Observation and Photography

Eastern Idaho birders have recognized the wooded area at Camas NWR as a migration hotspot for decades. Increased birding attention in the past decade has yielded numerous sightings of birds never previously documented in Idaho in addition to impressive numbers of more common species. Alternative 2 and Alternative 3 provide a moderate increase in non-consumptive recreational opportunities at the Refuge compared to the present. Alternative 2 (Preferred Alternative) would increase public recreational infrastructure and opportunities for wildlife observation and photography through the construction of the visitor contact station, kiosks, 1.3 mile birding trail, and wildlife observation platform. Alternative 3 would provide even more non-consumptive recreational opportunities, compared to Alternative 2, with more roads open to vehicular access (the 7.5 mile Sandhole Lake loop), groomed trails for cross-country skiing and snowshoeing, and three permanent photo blinds. A Complex visitor services position would allow the Refuge to recruit and train more volunteers to provide expanded visitor services programs, including more wildlife-based refuge tours. Off road hiking (which is currently allowed throughout the Refuge July 15-February 28) would be prohibited in Alternative 2 and limited to 2,510 acres (the north and south waterfowl hunting units) in Alternative 3. However 27 miles of service roads would continue to be open to pedestrians and bicyclists.

Currently (Alternative 1) the auto tour route is open to vehicle traffic (vehicles licensed for highway use only), bicycling, walking, dog walking (under control of owner), cross-country skiing, and snow shoeing. Few visitors have been observed walking or bicycling on the auto tour route and currently conflicts between vehicles and pedestrians, bicyclists, or any other visitor uses are negligible to nonexistent. Based upon data gathered from a vehicle traffic counter installed on the auto tour route in 2009, 50 to 370 vehicles per month used the route, with the peak occurring from March to June. To date no accidents or incidents on the auto tour route have been reported or observed by refuge staff. The auto tour route is currently maintained in winter to the best of the Refuge’s abilities to keep the road open. In the Preferred Alternative (Alternative 2) maintaining the auto tour route for one-way traffic would eliminate many of the issues with cars trying to pass on the narrow roads with steep ditches.

Interpretation and Environmental Education

Environmental interpretation is a process that forges emotional and intellectual connections between the interests of the audience and the resource. Interpretation includes those activities and infrastructure that explain management activities, fish and wildlife resources, ecological processes, and cultural history to the visiting public. Environmental education is a more formal process with activities conducted by refuge staff, volunteers, teachers, or other leaders. Environmental education strives to increase people’s knowledge and awareness about the refuge environment, resource management challenges, wildlife and their habitats, the human environment, and human impacts on wildlife and habitats.

Alternative 1 (Current Management) would continue to provide a small self-service visitor contact station and use refuge volunteers to provide environmental education programs. Alternative 1 (Current Management) would not increase environmental education staffing or construct an environmental education facility.

Alternatives 2 and 3 both enhance environmental educational opportunities at Camas NWR, with a strong emphasis on partnerships, increased staffing, volunteer coordination, and the addition of a visitor contact station and multi-purpose room. Increased environmental education and interpretation opportunities arise from implementation of Alternatives 2 and 3 through an emphasis on increased viewing facilities and increased offerings of interpretive and educational programs. Guided wildlife viewing tours would increase from a few in Alternative 1 (Current Management) to eight guided tours annually in Alternative 2, and twelve guided tours annually in Alternative 3.

Under Alternatives 2 and 3, a Park Ranger would be hired for Camas NWR and to expand the environmental education program and a Visitor Service Manager position would be stationed in the Southeast Idaho NWRC office in Pocatello to expand refuge volunteer opportunities. This staff position would recruit volunteers and work with the local schools to develop and grow the environmental education program. The Visitor Service Manager and Park Ranger would tie refuge environmental education programs directly into curricula for local schools. Alternatives 2 and 3 could use refuge programs to assist the schools with State education requirements, and teach-the-teacher programs would be initiated, thus reducing the amount of refuge staff and volunteer time required to facilitate classes. Alternatives 2 and 3 would subsequently provide high quality environmental education programs without having to invest heavily in curriculum development.

Interpretation and education programs proposed under Alternatives 2 and 3 would have moderate positive beneficial effects on opportunities for environmental education and interpretation. Moreover, these programs would have positive effects on refuge resources by increasing public awareness of, and appreciation for, these resources; informing visitors about proper resource use; and instilling a sense of stewardship in both visitors and the regional public.

6.13.3 Effects from Consumptive Public Recreational Use

Waterfowl and Upland Game Bird Hunting

Hunting has the potential to conflict with and decrease the quality of wildlife observation, photography, and environmental education. The estimated 6,000 to 7,000 annual visitors to Camas NWR are principally interested in non-hunting wildlife experiences. The Refuge offers a mix of wildlife-dependent uses, i.e., wildlife observation, photography, hunting, interpretation and education, and non-wildlife-dependent uses (i.e., hiking, biking, snowshoeing, and cross-country skiing) that can be negatively impacted by hunting, particularly the increased hunting activity in the proposed elk hunt.

No changes to the waterfowl hunting program are proposed in any alternative in the CCP. Moreover, numbers of waterfowl hunters using the Refuge are low and not expected to increase dramatically due to the lack of late season water in most years. The waterfowl hunt area gets relatively little use by nonconsumptive users during the waterfowl hunt season. Therefore the impacts to the quality of the wildlife observation, photography, interpretation, and environmental education opportunities on Camas NWR would be negligible.

No changes to the upland game bird hunting program are proposed in any alternative in the CCP. As with waterfowl hunting, numbers of upland game bird hunters are low, and few visitors use the hunt area during the hunting season. Therefore the impacts of upland game bird hunting to wildlife observation, photography, interpretation, and environmental education opportunities on Camas NWR would be negligible. However, changes in wetland management in Alternative 2 (Preferred

Alternative) and Alternative 3 may improve vegetation cover and winter survival of pheasants, thereby potentially improving pheasant hunting opportunities and providing minor negative conflicts and effects to non-consumptive recreationists interested in fall wildlife viewing and photography on the Refuge.

Big-Game Hunting

Big game hunting would not be allowed in Alternative 1 (Current Management). In Alternatives 2 and 3 we propose to establish a limited elk hunt in line with State seasons (August 1-December 31) and regulations for GMU 63. A maximum of 20 big game hunters would be permitted on the Refuge annually, with a maximum of two hunters on the Refuge at any one time. To minimize the potential conflict between elk hunting and other public uses and ensure visitor safety, the Refuge would designate a 4,112-acre hunting area in Alternatives 2 and 3 (see Chapter 2, Maps 7 and 8). Public use roads within the elk hunt area would remain open to non-hunting visitors and would be clearly signed to alert all visitors that they are entering a hunt area. Under Alternative 2, off road hiking would not be allowed on the Refuge, except for hunters in possession of valid permits and licenses, during the hunt season. In Alternative 3, the south waterfowl hunt area, which lies within the elk hunting area, would be closed to off road hiking, other than by hunters, during the elk hunting season. This effect is considered minor in the context of refuge wildlife observation areas available over the course of the year, and the fact that few visitors currently use the proposed elk hunt area. We expect that the majority of nonconsumptive use would continue to occur on the 6.3-mile refuge auto tour route and 1.3 mile birding trail and observation deck which are in the “no hunting” area and outside the elk hunt unit boundary. For these reasons, we also expect conflicts between hunters and non-consumptive users to be minimal. Requiring orientation sessions for all hunters would also help eliminate possible use conflicts. Maps, signage, and enforcement of existing State regulations that prohibit discharge of firearms from or across public right of ways, would minimize risk of trajectories into the non-hunting portion of the Refuge.

While the general assumption is that elk hunting may have a minor negative effect on refuge wildlife observation and photography opportunities, it is also possible that wildlife observation and photography opportunities could be increased as elk move away from the hunted zones toward no hunting zones. However, it is also possible that hunters could move elk off the Refuge entirely, decreasing opportunities to observe and photograph elk during the hunt season. Due to uncertainties in the response of wildlife to refuge hunting disturbance, the Refuge has developed strategies to work with Idaho Department of Fish and Game to re-assess the effectiveness of the elk hunt every five years and re-evaluate the hunt related to both consumptive and non-consumptive recreational objectives for the Refuge. Refuge personnel would also meet in January to evaluate the safety and quality aspects of this hunt and make adjustments to number of hunters and area closures if necessary to minimize impacts to sensitive non-target wildlife resources. If refuge closures do occur, the general public would be notified of closure dates via press releases to local media and the refuge website. With these strategies in place, and a maximum of 20 big game hunters permitted annually and only two hunters being allowed on the Refuge at any one time, conflicts with non-consumptive users should be minimal and only impart a minor negative effect to recreational wildlife observation and photography opportunities.

6.13.4 Overall Effects to Wildlife Observation, Photography, Interpretation, and Environmental Education

Overall, a moderate positive effect would occur for visitor opportunities to enjoy quality wildlife observation, photography, interpretation, and environmental education under Alternatives 2 and 3.

Waterfowl and upland game bird hunting effects to wildlife observation, photography, interpretation and environmental education would remain low in all alternatives. Alternative 1 would not open the Refuge to big-game hunting and no negative effects to non-consumptive wildlife observation opportunities or users would occur in this Alternative. The proposed new elk hunt in Alternatives 2 and 3 would cause a minor negative effect to non-consumptive recreational uses during the fall season.

6.14 Effects to Opportunities for Quality Hunting Experiences

Hunting, trapping and fishing are considered by many to be a legitimate, traditional recreational use of renewable natural resources. The National Wildlife Refuge System Administration Act of 1966, other laws, and the Fish and Wildlife Service's policy permit hunting on a national wildlife refuge when it is compatible with the purposes for which the Refuge was established and acquired.

National wildlife refuges exist primarily to safeguard wildlife populations through habitat preservation. The word "refuge" includes the idea of providing a haven of safety for wildlife, and as such, hunting might seem an inconsistent use of the National Wildlife Refuge System (Refuge System). However, habitat that normally supports healthy wildlife populations produces harvestable surpluses that are a renewable resource.

The decision to permit hunting, trapping, and fishing on national wildlife refuges is made on a case-by-case basis that considers biological soundness, economic feasibility, effects on other refuge programs, and public demand (See Compatibility Determinations: Appendix B).

6.14.1 Effects from Habitat Actions

Wetland Management

Due to the declining water table in the area over the last 20 years, waterfowl hunting opportunities have declined to the point where they are almost non-existent at Camas NWR. Alternative 1 uses a more prescriptive approach to wetland management, with stable water regimes that provide site "consistency" to public recreation interests. However, stable water regimes also lead to long-term declines in wetland productivity and therefore, reduced availability of huntable wildlife (Fredrickson and Reid 1990; Weller 1999). Currently the Refuge cannot reliably maintain water in the hunt units in the fall and therefore waterfowl hunting opportunities are limited and variable from year to year.

Alternatives 2 and 3 would improve wetland habitat conditions as compared to Alternative 1. These alternatives would substantially increase the integrity and quality of wetland habitats by mimicking natural variability and dynamic ecosystem processes (e.g., drought, flood, fire). The more dynamic and variable wetland management proposed in Alternatives 2 and 3 would cause "irregularity" in wetland habitats on a site-by-site basis in the short term. For example, the Refuge may keep some units drawn down for longer periods of time to promote either submerged aquatic vegetation for next spring or annual wetland plants with lower tolerance for inundation, but a high wildlife forage value. Reliable waterfowl hunting areas may not be consistently available or hold high concentrations of waterfowl in years when water level management is mimicking extreme drought or flood scenarios. However, an increase in productivity of the refuge marsh habitats would occur in the long term (Fredrickson and Reid 1990; Hammer and Kadlec 1986; Middleton 2002; Reid 1989), which may increase public waterfowl hunting opportunities in the long term. If the implementation of the 2017 Camas NWR Wetland and Riparian Rehabilitation Plan is successful in improving refuge wetland habitats, the effect could be particularly pronounced for waterfowl.

Overall, Alternatives 2 and 3 would be expected to have a higher likelihood of improving opportunities for waterfowl and upland game bird hunting than Alternative 1. However, opportunities would be variable from year to year.

Changes in wetland management in Alternative 2 (Preferred Alternative) and Alternative 3 may improve vegetation cover and winter survival of pheasants, thereby potentially improving pheasant hunting opportunities.

Upland Management

Upland game hunting opportunities are currently minimal on the Refuge. With overall drier conditions and a less consistent hydroperiod from year to year, pheasant numbers have never rebounded to the high populations of the 1960s. Loss of quality sagebrush habitat in the surrounding area has led to a decline in the number of sage grouse on the Refuge. Upland management under Alternatives 2 and 3 would be likely to improve habitat conditions for sage-grouse. This would be more pronounced under Alternative 3 with its greater emphasis on restoration of sagebrush-steppe habitat. This may lead to a minor positive effect to opportunities for upland game bird hunting.

6.14.2 Effects from Management of Consumptive Public Recreational Use

Waterfowl and Upland Game Bird Hunting

The total number of hunt days, hunt units, hunting acres, and facilities available for waterfowl and upland game bird hunting would remain the same in all alternatives. No increase or decrease in opportunities for waterfowl and upland game bird hunting would occur through implementation of the Preferred Alternative 2, or Alternative 3.

Big-Game Hunting

The Refuge is currently closed to big game hunting (Alternative 1, Current Management). At the request of IDFG, Camas NWR would offer a refuge recreational elk hunt to assist in minimizing elk depredation complaints in the Preferred Alternative (Alternative 2) and Alternative 3. The Refuge's primary objectives for an elk hunt are to offer quality recreational hunting opportunities, with priority to youth and mobility impaired hunters, and to assist the IDFG with depredation issues on surrounding private lands.

The proposed elk hunt unit would be approximately 4,112 acres in size and located in the southern and western sections of the Refuge, south of the Auto Tour Route and west of Camas Creek. The Refuge would issue up to 20 refuge access permits annually within GMU 63. An any-elk hunt would be conducted from August 1 through August 31 and an antlerless-only hunt from September 1 through December 31. Access permits would allow hunters to hunt elk on the Refuge five days a week for a two-week period, until an elk is harvested. No more than two hunters may be present on the Refuge at any given time.

The Idaho Department of Fish and Game (IDFG) manages the elk in GMU 63 primarily reduce crop depredation and secondarily, to provide recreational opportunities. For the past fifteen years or so this unit has had one of Idaho's longest and most liberal (five months long) elk hunting seasons. Between 2006 and 2011 harvest in the unit has ranged from 70 in 2011 to 257 in 2010. Assuming that a maximum of 20 elk would be harvested on the Refuge annually, Alternatives 2 and 3 would provide a minor increase in elk hunting opportunities in GMU 63. The controlled Refuge hunt would provide a high quality opportunity since only two hunters would be allowed on the Refuge at a given time. Providing some hunting pressure on the Refuge may deter elk from using the Refuge as a safe haven and disperse them onto areas open to all hunters in GMU 63, thereby increasing hunter success in areas adjacent to the Refuge. The Refuge would work with IDFG to re-assess the effectiveness of the elk hunt every five years and re-evaluate the hunt related to both IDFG depredation issues and the recreational objectives of both IDFG and the Refuge.

6.14.3 Effects to Hunting Opportunities from Non-Consumptive Public Recreational Use

Wildlife Observation, Photography, Interpretation, and Environmental Education

These four priority public uses would largely be self-guided and would be allowed on the auto tour route, trails, and facilities described above. Users would include the general public, as well as organized groups, including schools and youth groups.

Wildlife watchers, birders, and photographers have the potential to disturb wildlife that hunters are pursuing and lessen the quality of the hunting opportunity. To minimize this potential conflict, the Refuge has designated defined hunting areas in Alternatives 2 and 3 that would be separated spatially from areas where most nonconsumptive uses occur (hiking trails, the Auto Tour Route, and associated facilities). The elk hunt area (which overlaps with and includes the 1,530 acre south waterfowl hunting unit) would remain open to non-hunting public uses during the elk hunt season (August 1-Dec 31) In Alternative 2, off road hiking would be prohibited, except by hunters in pursuit of game. In Alternative 3 off road hiking would be allowed in waterfowl hunt units, which partially overlap the elk hunting area, but only after the close of the elk hunting season. Therefore other uses would be limited to service roads within the hunt area in both Alternatives 2 and 3. As noted in Section 6.13.3 above, few visitors currently use the proposed elk hunt area, and conflicts between elk hunters and other users would be expected to be minor. Additional measures taken in Alternatives 2 and 3 to reduce potential conflicts between user groups would include providing information at the parking lots, refuge headquarters and in the Refuge's brochure (available both at headquarters and kiosks, and on the refuge website) that clearly indicates permitted uses and rules of conduct. In all alternatives, hunt areas would be clearly signed and maps and regulations would be included in brochures and the Refuge Web site.

6.14.4 Overall Effects

Overall, there would be a moderate positive effect to hunting opportunities under Alternatives 2 and 3, compared to current opportunities.

6.15 Effects to Cultural Resources

The Service is committed to protection of known cultural resources under all alternatives of the Camas NWR CCP. The Refuge Cultural Resource Management Plan (Appendix H) is an integral part of Camas National Wildlife Refuge management, not just because the law mandates it, but for the unique information it can bring to understanding our environment. In general this plan will help to strengthen long-term protection and preservation of all cultural resources on the Refuge.

6.15.1 Paleontological Resources

There are no known paleontological resources on Camas NWR. Because of the active volcanic basalt flows across the region it is unlikely that paleontological resources would be found with the refuge boundaries (USFWS 2011). Under all alternatives, should paleontological specimens be discovered, the collection and curation of paleontological resources should be managed under the Department of the Interior’s Museum Property program and the Paleontological Resources Preservation Act (PRPA) of 2009.

6.15.2 Prehistoric/Ethnographic Resources

Prehistoric Sites and Artifacts

Although archaeological evidence of Native American use on Camas NWR is limited to five sites and an isolated projectile point, the use of the area by Shoshone and Bannock people is expected. One site contains rock circles that may be the remnants of tipi rings and was recommended to be eligible to the NRHP (Harding 2005). There has never been a large scale village, burials, or Paleoindian site identified within the Camas NWR boundaries.

The presence of such a small number of sites relating to Native American people on the Refuge is probably due to the fact that less than half of the Refuge has been surveyed for archaeological evidence, because of the marshy condition of the refuge core area and historic agricultural activities that included building irrigation canals and plowing fields.

Under all alternatives the Refuge would develop, in partnership with the Tribes and other preservation partners, a program for the education and interpretation of cultural resources of the Refuge. Since cultural resources are not renewable, interpretation of cultural resources can instill a conservation ethic among the public and others who encounter or manage them. Once implemented, the cultural resource education and interpretive program (Appendix H) would improve the management of refuge cultural resources, by: (1) translating the results of cultural research into media that can be understood and appreciated by a variety of people, (2) relating the connection between cultural resources and natural resources and the role of humans in the environment, (3) fostering an awareness and appreciation of native cultures, and (4) instilling an ethic for the conservation of our cultural heritage.

Traditional Cultural Properties

The Big Southern Butte and its associated sacred landscape are very important to the Tribes. In essence, the Big Southern Butte sacred landscape consists of the area observed from the top of Big Southern Butte. This butte is visible from Camas NWR, and under all alternatives, effects to the Big Southern Butte viewshed would be included when changes to landscape appearance are proposed.

Native American Graves Protection and Repatriation Act

None of the archaeological sites recorded on Camas NWR are documented as containing human remains. However, if sites identified on the Refuge are found to contain human remains, funerary items, sacred objects, or items of cultural patrimony then consideration under the Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) will be required.

In all alternatives, a proactive approach to management of sites with human remains would be to follow the NAGPRA consultation process *prior* to any inadvertent discovery. This process should result in a Memorandum of Understanding that specifies the appropriate individual(s) or group(s) to contact if there is an inadvertent discovery or intentional excavation (See Appendix H: Cultural Resources Plan). The document should describe the appropriate treatment of human remains and burial objects. The Refuge will enter into discussions to identify and describe other items of NAGPRA concern: funerary objects, sacred objects, and objects of cultural patrimony. Development of a Memorandum of Understanding prior to an inadvertent discovery is strongly suggested by the NAGPRA implementing regulations (NAGPRA 1990). Such an agreement would not only greatly facilitate and speed up consultations as required by law after an inadvertent discovery, but build trust and respect between the Service and Native American groups (Cryne 2010). Without an agreement document, an inadvertent discovery of human remains on the Refuge would trigger a similar process but would require completion under pressure in a matter of days.

6.15.3 Historic Resources

Under all alternatives, we would develop preservation plans prior to restoration of significant historic buildings and structures to ensure that repairs are cost effective and historically appropriate. Adaptive reuse will be considered as a way to preserve and interpret historic buildings. In all alternatives, consultation with the State Historic Preservation Office (SHPO) regarding changes that affect sites, buildings, or WPA structures listed on or determined eligible to the NRHP will be undertaken.

In all alternatives, the Refuge will conduct cultural resource surveys before any major construction or habitat restoration project. These projects may include, but are not limited to, the construction of roads, trails, bridges, dikes, and visitor facilities. Earth moving activities occurring in proximity to known sites would be monitored because of the potential for buried cultural material in these areas. If any cultural materials are uncovered during excavation, the Regional Historic Preservation Officer would be contacted to review the materials and recommend a treatment that is consistent with applicable laws and policies. Any new cultural resources identified during the survey would be recorded and evaluated for eligibility to the NRHP. If any sites are determined to be eligible to the NRHP, restoration plans would need to be assessed for potential effects to the historic property. If effects are possible, the proposal would be reviewed to ensure that the effects have the least impact to original materials and are in conformance with the Secretary of the Interior’s Standards for the Treatment of Historic Properties. Changes that comply with the Secretary’s Standards would have no adverse effect on historic properties. Once an assessment has been completed, the findings would be forwarded to SHPO for concurrence. Implementation of the procedures described above is expected to avoid adverse effects to historic resources; however, additional analysis under NEPA may be required once specific details are known.

The construction of public use facilities proposed under Alternatives 2 and 3 would not be expected to have an adverse effect on historic resources. Major disturbance would be avoided by the survey and consultation process as described in Section 106 of NHPA described above. Expansion of facilities and trails under the alternatives would receive the same scrutiny, to ensure they would not detract from cultural resources; therefore, no adverse effects to cultural resources as a result of human activity within the Refuge are anticipated.

Under all alternatives, the Service would implement a proactive cultural resources management program that focuses on meeting the requirements of the National Historic Preservation Act, including consultation, identification, inventory, evaluation, and protection of cultural resources (Appendix H). Various Federal historic preservation laws and regulations require the Service to implement the kind of program described under this objective (ARPA 1979 [U.S.C. 1979]; NHPA 1966 [U.S.C. 1966]; NAGPRA 1990 [U.S.C. 1990]). Furthermore, inattention to these responsibilities could obstruct the Refuge in its other land, habitat, and wildlife management efforts.

6.15.4 Cultural Resource Survey and Future Management

Under all alternatives, we would continue to survey cultural resources in response to implementation of refuge projects and activities that had the potential to affect those resources. In addition, we would initiate a program for systematic archaeological survey and site inventory to better assist the Refuge in developing a better understanding of which areas of the Refuge may be sensitive for the presence of cultural resources. The program should include evaluating through a formal Determination of Eligibility process to highlight the significant properties. Then, based on the historic properties, a program for interpreting, monitoring, and protecting these cultural resources can be implemented into refuge management.

6.15.5 Overall Effects

Based on the criteria for assessing adverse effects that are provided in the NHPA, all of the alternatives are considered to be a “No Adverse Effect” undertaking as per 36 CFR Part 800.5(3)(b), hence none of the alternatives would have a significant impact to cultural resources. The Service’s determination of no adverse effect would be submitted to SHPO for concurrence. No mitigation would be required.

6.16 Economic Effects

The economic influence area is mainly rural Jefferson County, Idaho, where the Refuge is located, and Bonneville County Idaho and Idaho Falls where most refuge transactions occur. Many refuge visitors live within these counties and are assumed to make most of their purchases within those counties. A detailed comparison of salaries, annual expenses, and one time expenses by alternative can be found in Appendix C, Implementation.

Refuge Salaries: Camas National Wildlife Refuge has both direct and indirect economic impacts on the local economy. The refuge budget supports employee salaries, operations and maintenance costs, and various programs. Current staffing consists of 2.5 permanent full time employees stationed on the Refuge, whose annual payroll (including salaries and benefits) totaled 222,000 in 2012. (The Refuge Biologist position is shared with Grays Lake NWR.) Under Alternatives 2 and 3 we propose to add two permanent full time employees (Park Ranger and Engineering Equipment Operator) to the refuge staff. The annual refuge payroll under Alternatives 2 and 3 would total $363,500. Currently, a number of positions are shared among the four refuges in the SE Idaho Complex. These positions are stationed in Chubbuck, Idaho. Camas's share of these positions currently totals 1.5 FTEs (full time equivalents), with the Refuge's share of the annual payroll totaling $146,000. In Alternatives 2 and 3 we propose an additional Complex position (Visitor Services Manager) that would be shared among the four refuges in the Complex. This would bring Camas's share to 1.75 FTEs, with the Refuge's portion of the annual payroll totaling $171,000.

Since refuge operational expenditures would vary by alternative based on staffing levels and programs associated with each alternative (see Implementation Plan: Appendix C), each alternative would result in a different degree of economic effect. One-time expenses for maintenance and improvement of habitat and facilities would be approximately $78,000 under Alternative 1, with annual recurring costs of approximately $350,000. Alternative 2 (Preferred Alternative) would have recurring costs of approximately $500,000 annually, and one-time expenditures for habitat restoration and public use facilities of approximately $1,161,000. Alternative 3 would have recurring costs of $511,000 annually, and one-time expenditures for habitat restoration and public use facilities of approximately $1,195,000.

Refuge Expenditures: Most infrastructure improvements would be one-time costs through increased spending by the Refuge related to improvements to infrastructure and public use facilities (e.g., auto-tour route, Visitor Contact Station, interpretation kiosks). Effects are considered significant if the gain or loss in total personal income stemming from expenditures associated with the Refuge exceed 5 percent of the total personal incomes of the counties in the economic influence area.

At times the Refuge receives funding allocations for capital improvements for facilities including but not limited to buildings, water management infrastructure, and roads. Spending associated with these activities results in local economic effects. In addition to providing salaries and benefits, the Refuge purchased goods and services totaling $128,000 in 2012, approximately 25% of which was spent locally in the Jefferson County economy. Under Alternative 1, an additional $78,000 would be spent on one-time project costs over the 15 year lifetime of the CCP. Alternatives 2 and 3 require a higher level of staffing and expenditure on habitat restoration, public use programs, and infrastructure than Alternative 1. In Alternatives 2 and 3, $137,500-$148,000 (an additional $10,000-$20,000) would be spent annually on goods and services. Expenditures for one time projects, including infrastructure and capital improvements (Refuge office and Visitor Contact Center), habitat restoration projects, and scientific studies needed to accomplish habitat restoration and adaptive management of the Refuge, total $1,161,000 (Alternative 2) and $1,195,000 (Alternative 3).

All alternatives would have a minor positive effect on the local economy. Expenditures over the 15-year lifetime of the CCP would total $5.3M under Alternative 1, $8.6M under Alternative 2, and $8.9M under Alternative 3. All alternatives would have a positive economic benefit; however, Alternative 1 would have the least economic benefit locally as a direct result of Refuge expenditures, with fewer jobs and less personal income generated than Alternatives 2 and 3. The effect of Alternatives 2 and 3 would still be minor in terms of the overall economy of Jefferson County.

Payment in Lieu of Taxes: Under Federal law, local governments may be directly compensated through various programs for losses to their property tax bases due to the presence of federally owned land. These lands cannot be taxed, though they may create demand for services such as fire protection, or police cooperation. The most applicable program, administered by the Department of the Interior (DOI), is called "Payments in Lieu of Taxes," or PILT. Lands within the National Wildlife Refuge System (NWRS) that are withdrawn from the public domain are eligible for PILT, and those that are acquired are not (Corn 1998). There are no NWRS lands within the State of Idaho that are eligible for PILT (Corn 1998).

Refuge Recreation: The Refuge also provides an indirect economic impact on the local economy through the recreational activities that it offers. These activities—wildlife viewing, photography, environmental education and interpretation, waterfowl and upland game bird hunting, hiking, bicycle riding, cross-country skiing, and snowshoeing—would all continue under all alternatives. In Alternatives 2 and 3 a limited elk hunt would be established on the Refuge. People that participate in these activities on the Refuge frequently buy goods and services in nearby towns (e.g., food, lodging, fuel, equipment) and are contributing to the local economy. The action alternatives (2 and 3) would provide a minor positive effect to the local economy through the increased visitation that would result from better facilities and additional programs.

It is estimated that visitors to a single refuge spend about $1.7 million per year in the local economy (Caudill and Henderson 2005). Every $1 in the refuge budget, the authors estimate, generates $4.29 in economic benefit locally. Note that this ratio broadly compares the magnitude of recreational benefits and the refuge budget and should not be used as a benefit-cost ratio (Caudill and Henderson 2005).

Future visitation will be affected by demographic changes and recreation trends as well as the facilities and programs offered by the Refuge. Based on current visitation patterns and predicted trends, we predict that the greatest increase in visitation to Camas National Wildlife Refuge, both by percentage increase and total number of visitors, will be from visitors who engage in wildlife observation and photography. With additional support for environmental education and interpretation in the Action Alternatives, participation in these programs would also be expected to increase. Overall recreational visitation is expected to increase similarly in Alternatives 2 and 3, because of improvements to visitor facilities and expanded capability to offer visitor programs. As a result, these alternatives may generate a few local jobs and have a slightly greater local economic effect, than Alternative 1.

Visitors from outside of the local area spend more money in the local area (motels, restaurants) while recreating on the Refuge than local residents do. Spending by nonresidents due to choosing the Refuge as a recreation destination thus represents an infusion of money into the local economy that would not occur if the Refuge were not there. If the Refuge did not exist, local residents would possibly take advantage of similar recreational opportunities nearby, such as local state parks. To the extent that nearby areas could replicate the recreational experiences provided at the Refuge, the expenditures made by these visitors may have taken place inside the county regardless of the Refuge's existence. Hence, the analysis may overestimate somewhat the contribution of the Refuge to the local economy. The establishment of an elk hunt on Camas NWR may have a small positive impact on the local economy both by sales of goods and services to hunters, and by reducing agricultural depredation on adjacent private lands.

Refuge Agriculture: Agriculture and food processing are the largest basic industries and dominate the economy of Jefferson County; however, government and trade sectors provide the largest employment (Idaho Department of Commerce 2010).

The majority of the small grain farming undertaken on the Refuge is conducted by local area farmers working under cooperative farming agreements with the refuges. The basic premise for the cooperative farming program is that the Refuge is able to provide green alfalfa forage crops for migratory birds and the local area farmers are then able to harvest alfalfa hay during the summer months. Cost is always a consideration when planting cereal grain crops. In exchange for being able to harvest the alfalfa, cooperative farmers plant 20 acres of small grain, which is left for wildlife. The Refuge would like to continue the cooperative farming program, but rising costs associated with farming as well as increased wildlife browsing may lead to declining profits for cooperative farmers on the Refuge. Should cooperative farming no longer be practical for local farmers, the Refuge would continue to farm the acres indicated in Alternative 2 with refuge personnel, equipment, and funding.

Agriculture yields are higher with irrigation, but crops grown without irrigation will always be less expensive. Should cooperative farming become less attractive to local farmers or not cost effective for the Refuge, the Refuge would transition from irrigated alfalfa to the dry land grain and alfalfa in the Preferred Alternative.

In the State of Idaho the price of hay and the number of acres harvested has remained fairly stable over the last 20 years. Total hayed acres harvested have fluctuated between 900,000 and 1.2 million acres over the time period of consideration. Hay prices have remained quite stable in the $80-$100 per ton range until 2007 when the price of alfalfa hay began to skyrocket. By 2008 the price of hay in Idaho had peaked in excess of $200/ton and by 2009 hay prices had once again come into check at values of $115/ton (Greenway and Gray 2011).

Haying would occur on 150 irrigated acres annually in Alternatives 1 and 2, and 150 dryland acres in Alternative 3. Extrapolating the yield of approximately 0.50 tons/acre from Camas NWR generates an estimated annual yield of 75 tons of hay from 150 acres in Alternatives1 and 2, and 35 tons or less in Alternative 3, since hayfields would no longer be irrigated under this alternative. Therefore, the total annual production in Alternatives 1 and 2 is approximately worth $6,500. Alternative 3 would generate $3,250 or less in hay value or revenues.

The IDFG has not established elk population goals or bull:cow ratio objectives for GMU 63, and essentially conducts depredation control of the elk herd through recreational hunting, by offering general tag opportunities. Currently, elk hunting is not allowed on the Refuge. At the request of IDFG, Camas NWR would offer a refuge recreational elk hunt to assist in minimizing elk depredation complaints in the Preferred Alternative (Alternative 2) and Alternative 3. Up to 20 elk could be harvested on the Refuge, but total harvest in GMU 63 may increase because elk are being dispersed off the Refuge, onto areas open to all hunters. This may result in reduction of herd size, reduction in depredation, and minor economic benefits to local farmers.

Regional Economy: In 2011, Idaho had a total personal income (TPI) of approximately $52.1 billion with a 2per capita income of $32,881 among a population of 1,584,985 people. In comparison to the State of Idaho, the per capita income in Jefferson County, Idaho (population 26,301) was $27,612 (Idaho Department of Labor 2011). A detailed economic analysis of the alternatives was not completed to determine the multiplier effects the alternatives would have on the county. Based on the background information presented above and the estimated changes in refuge spending under Alternatives 2 and 3, the Refuge's effect on total personal income in Jefferson County under Alternatives 2 and 3 would be minor because the effect of refuge expenditures on the county TPI would not exceed 5 percent of the total.

6.17 Cumulative Effects

Council on Environmental Quality (CEQ) regulations, which implement the provisions of NEPA, define several different types of effects that should be evaluated in an environmental document, including direct, indirect, and cumulative effects (40 CFR § 1508.7). Direct and indirect effects are addressed in the resource-specific sections of this chapter (Sections 6.1-6.15). This section addresses cumulative effects.

According to the CEQ, 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, regardless of the entity undertaking the action. Cumulative impacts can result from individually minor but cumulatively significant actions over a period of time. This analysis is intended to consider the interaction of activities at Camas NWR and with other actions occurring over a larger spatial and temporal frame of reference.

It should be noted that the cumulative effects analysis has essentially been completed by virtue of the comprehensive nature by which the direct and indirect effects associated with implementing the various alternatives has been presented in the previous sections of this chapter and in the Compatibility Determinations (Appendix B). The analysis in this section primarily focuses on effects associated with reasonably foreseeable future events and/or actions regardless of what entity undertakes that action.

6.17.1 Effects from Reasonably Foreseeable Future Refuge Activities

The potential for more benefit to conservation of native species of the Upper Snake Region exists under all alternatives, because the Service would develop a land protection plan. Under all alternatives, a Preliminary Project Proposal (PPP) would be developed within three years of CCP completion. If the PPP by the USFWS Director is approved, a more detailed Land Protection Planning (LPP) process would then be initiated to address large-scale land protection alternatives and help to prioritize adjoining lands that are most critical for protection of refuge water quality and quantity; have the highest quality sage-steppe and wetland habitat; and provide the best opportunities for habitat restoration. This plan would provide a mechanism for further protection and restoration of habitats outside the current refuge area via easements, acquisition, cooperative agreement, and/or other means, for further protection and restoration of native habitats that may presently, or could in the future, support rare species.

On a smaller scale the Refuge would actively pursue land protection and acquisition within and adjacent to the boundary of Camas NWR. Land protection actions would be prioritized for: lands with existing commitments to purchase or protect; lands with active water rights attached to them; biological important habitat for wildlife species; significance of the area to refuge management and administration; and lands with existing or potential threats to wildlife habitat, which need to be remediated.

6.17.2 Potential Effects from Climate Change

Climate change in the western United States has been particularly noticeable in the last century, with increases averaging 0.5-2°C (0.9-3.6°F) in mean annual temperatures, depending on elevation (Diaz and Eischeid 2007; Pederson et al. 2010). Warmer winters and springs have resulted in more precipitation falling as rain instead of snow, reduced snowpack, earlier snowmelt, earlier streamflow from snowmelt, an eight to ten day advance in the onset of spring on average across the West, more frequent large fires, and possibly an increase in insect outbreaks and plant mortality (Breshears et al. 2005; Cayan et al. 2001; Knowles et al. 2006; Mote et al. 2005; Pederson et al. 2010; Raffa et al. 2008; Stewart et al. 2005; Westerling et al. 2006). The preponderance of evidence suggests that the magnitude of these changes has been influenced by human activity. Barnett et al. (2008) used nested climate and hydrological models to attribute most of these changes in the West to greenhouse gas emissions and their impact on global and regional climate. Another modeling study suggests that these changes are caused by a blend of anthropogenic forces Pacific and Atlantic decadal variability (Wang et al. 2008).

Projected rise in temperature for the coming century is expected to increase the proportion of winter precipitation falling as rain, increase the frequency of winter flooding, reduce snowpack, increase winter streamflow, result in earlier peak streamflow, and decrease late spring and summer streamflows (Hamlet and Lettenmaier 1999; Hamlet et al. 2007; Mote 2003, Mote et al. 2005; Payne et al. 2004; Tague et al. 2008).

Unless otherwise noted, the projected trends, cumulative effects to wetland, riparian, upland, and fire regimes from climate change were abridged from Ashton (2010); “Observed and Projected Ecological Responses to Climate Change in the Rocky Mountains and Upper Columbia Basin”.

Potential Effects of Warming to Hydrology and Wetland Habitats

Wetlands are among the most significantly altered ecosystems in North America due to stressors such as changes in hydrology from flow regulation, groundwater pumping, fill placement, overgrazing, atmospheric deposition, and biological invasion (Patten 1998; Zedler and Kercher 2005). Over the last 200 years, wetland areas have declined approximately 56 percent in Idaho (OTA 1993). Like other freshwater ecosystems, wetlands are considered extremely vulnerable to climate change, which is projected to diminish their number and extent and cause a decline in associated flora and fauna (Field et al. 2007). Wetlands are already facing widespread degradation so that even small reductions in precipitation could exacerbate wetland loss.

Greater changes in wetlands are expected to result from altered precipitation affecting soil and vegetation conditions (Winter 2000). Many models project wetter winters in the region, but any positive effect of increased winter flows for wetlands is expected to be outweighed by drier summers and warmer temperatures. It is predicted that wetland response will first become evident in water table changes and alterations in the formation and duration of soil anoxic conditions. Alterations in the composition of short-lived and then longer-lived perennial plants will follow. Soils may be altered after many decades unless fire occurs. Alterations of plant cover and soil permeability may act in a feedback loop to further modify the hydrological cycle. Some wetlands, such as wet meadows, are particularly sensitive to hydrological changes and a reduction in the water table of a few inches could convert wetlands to upland habitats (Kusler 2006).

Potential Effects of Warming to Upland Native Habitats

Experimental work suggests that warming, particularly when coupled with drier conditions, can decrease sagebrush and grassland productivity and alter species composition (Poore et al. 2009). However, productivity is influenced by species diversity and grazing intensity (De Valpine and Harte 2001). Warming experiments in montane grassland enhanced the growth of sagebrush compared to herbaceous species (Perfors et al. 2003). However, grasslands do not appear to be as responsive to warming as other community types such as tundra and forests (Rustad et al. 2001). Because grasslands are primarily limited by water and nutrient availability, an alteration in precipitation and fertilization may have larger effects than does temperature change (Parton et al. 1994). Changes in the frequency, duration, or quantity of precipitation can cause large changes in productivity, composition, and associated fire regimes (Knapp et al. 2002). Precipitation increases may favor invasive species. For example, increases in snow were shown to increase the invasion of forbs into mixed grass prairie (Blumenthal et al. 2008). The invasion of sagebrush steppe by cheatgrass has been shown to be strongly influenced by temperature and precipitation (Chambers et al. 2009). Climate variability has been shown to promote stability in grasslands by facilitating the coexistence of different plant species (Adler et al. 2006). Increased atmospheric CO_2 may promote species compositional changes (Smith et al. 2000). There has been much work suggesting that rising CO_2 concentrations may differentially affect grasses. Enrichment experiments in the shortgrass steppe have seen moderate increases in grasses (Morgan et al. 2004) and a large increase in shrub biomass (Morgan et al. 2007). Weed invasion may also be driven by atmospheric CO_2 in semiarid ecosystems (Smith et al. 2000).

Potential Effects to Riparian Habitat and Camas Creek

Climate change may reduce water quality due to increased erosion and decreased dilution of pollutants. Decreases in snow cover and more winter rain on bare soil are likely to lengthen the erosion season, which could lead to average phosphorus concentrations in streams increasing 25 to 35 percent (Walker et al. 2001). Predicted increases in the severity and frequency of floods may also contribute to increases in erosion. This will affect ecological processes that are sensitive to the changes of high flow events, such as habitat stability, biodiversity, and trophic structure (Hamlet and Lettenmaier 2007; Konrad and Booth 2005). Degradation of water quality will likely lead to a reduction in or loss of sensitive stream species (Waters 1995).

Increased air and water temperatures and subsequent changes in hydrologic regime—especially changes in the timing, magnitude, and duration of high and low flows—are the principal sources of climate change impacts to Camas Creek. However, several other potential climate change effects are perhaps not as intuitively obvious. An example of such an indirect impact is increased sediment transport from tributary watersheds, leading to either direct fish mortality or additive physiological stress (SWCCI 2010). Another subtle but perhaps very significant impact is increased dust deposition due to climate change and poor watershed management. Research done in the central Rocky Mountains shows that increased dust deposition leads to earlier snowmelt and altered streamflow hydrology (Painter et al. 2007).

Potential Effects from Wildfires

Most evidence supports the postulate that future climate changes will cause increases in the frequency, intensity, severity, and average annual extent of wildland fires (Field et al. 2007; Ryan et al. 2008). Models project that numerous aspects of fire behavior will change, including longer fire seasons, more days with high fire danger, increased natural ignition frequency and fire severity, more frequent large fires, and more episodes of extreme fire behavior (Bachelet et al. 2007; Brown et al. 2004; Westerling and Bryant 2008). The best evidence, however, points to increases in the average annual area burned (Bachelet et al. 2007; Flannigan et al. 2006; McKenzie et al. 2004). For instance, McKenzie and colleagues (2004) predict that a mean temperature increase of 2.2°C (4.0°F) will increase the annual area burned by wildfire by factor of 1.5 to five. In another study, it is predicted that the median annual acres burned in the Upper Columbia Basin and northern Rockies would increase from about 0.5 million acres (0.2 million ha) in 2006 to 0.8 million acres (0.3 million ha) in the 2020s, 1.1 million acres (0.4 million ha) in the 2040s, and 2.0 million acres (1 million ha) in the 2080s (Littell et al. 2009).

While there is strong evidence that climate change will increase the number of fires, and particularly the area burned each year, uncertainties remain. First, historical patterns of precipitation are linked to fire and broad weather patterns that drive fire growth, such as high pressure ridges and wind patterns, and models differ in their projections for these climate variables. Other factors, such as increases in non-native, annual grass invasions, may alter fire dynamics, making predictions based on climate alone difficult. Finally, and perhaps most importantly, if fires and other stand-replacing disturbances occur more frequently, the resulting landscape pattern may limit the size of future fires and total area burned (Collins et al. 2009).

6.17.3 Other Reasonably Foreseeable Events and Activities from Others

Development and Population Growth in Jefferson, Bonneville and Madison Counties

Communities in the Upper Snake basin are presently encountering various intensities of growth and development due to new government (DOE Idaho National Laboratory), residential, commercial, and agricultural development. Since 2002 Jefferson County's population has steadily increased to 26,684 in 2012. Between 2002 and 2012 Jefferson County was the second fastest growing county in the state. The county is part of the Idaho Falls Metropolitan Statistical Area (MSA) and sits between the high-growth counties of Bonneville and Madison, which affects Jefferson since it gets their overflow (Idaho Department of Labor 2013a).

Bonneville County grew 25 percent from 85,060 in 2002 to 106,684 in 2012. The county has experienced steady growth in the last decade with an average population increase of 1,759 a year for the past five years. The largest increase was 3.12 percent between 2006 to 2007. Besides being a medical and retail hub for a large geographic area, diversity and an emphasis on economic development help the area grow (Idaho Department of Labor 2013b).

Madison County's population increased 32 percent between 2002 and 2012, primarily because of the 2004 conversion of two-year Ricks College to Brigham Young University-Idaho. The record-breaking enrollment the school had been experiencing has continued, pushing economic growth, especially through construction of student housing and campus expansion. BYU-Idaho plans to further expand its student population through 2015. The county has experienced tremendous growth since 2002, increasing by almost 9,000. A quarter of that occurred between 2003 and 2004. Over the last decade Madison County was the fourth fastest growing county in the state (Idaho Department of Labor 2013c).

The Camas NWR CCP does not directly address the above mentioned growth issues associated with the Idaho Falls MSA. However, refuge support and involvement in regional conservation initiatives will help maintain important habitat for a variety of fish, mammals, and migratory birds threatened by increasing cumulative habitat losses from development pressures and dispersed recreation.

Effects of Endangered Species

On March 10, 2010, the USFWS completed a court ordered assessment for the listing of the greater sage-grouse under the Endangered Species Act (ESA) and issued a “warranted, but precluded” ruling. The USFWS determination is based upon the latest scientific information from the U.S. Geological Society (USGS) published in Studies in Avian Biology that details sage-grouse population declines, habitat loss and fragmentation of sagebrush ecosystems resulting from the cumulative effects of a variety of causes.

While the sage-grouse’s decline warrants ESA listing, it must be delayed due to the backlog of other species that are already candidates for ESA listing. The decision means that the status of the greater sage-grouse will be evaluated every twelve months along with the status of the 279 other ESA candidate species. Making the greater sage-grouse a candidate species allows agencies like the Bureau of Land Management and Forest Service to treat the bird as if it were an endangered species, and requires state and Federal land management agencies to consult with USFWS whenever a proposed development would encroach upon greater sage-grouse habitat.

If the status of the greater sage grouse is more perilous in subsequent years, USFWS will be more likely formally list the bird under the ESA. When a species is formally proposed for listing, the endangered species designation process lasts about a year. While a species remains a candidate for listing, it still is possible to keep it off of the endangered species list if it shows recovery progress.

Effects of Local Conservation Partnerships

Friends Groups within the National Wildlife Refuge System have become numerous over the past ten years. Friends Groups essentially “adopt” individual refuges or complexes, advocate for their needs, and provide both financial and volunteer support to accomplish many essential tasks and projects. Friends Groups not only directly benefit refuges, but also empower members to become advocates for refuges, and conduct outreach that increases public awareness of, and involvement with, national wildlife refuges. This occurs both through direct contact and increasingly, through the Web and social media. Historically, Camas NWR has had many “friends” that performed a variety of tasks and work projects, but no official Friends Group. In 2011, a Friends Group for Camas NWR was formed and has received their 501(c)3 nonprofit status. It is important for the Refuge to support this new Friends Group since it will play a critical role in providing volunteer support for the Refuge’s biological and public use programs, and as an advocate for protecting refuge wildlife and habitat.

Regional Conservation Partnerships

Several conservation initiatives and partnerships have gained momentum in the Upper Snake River watershed or have potential for development. The aggregate effect of these partnerships will have a positive influence in implementation of site-specific and landscape scale conservation of imperiled resources within the watershed.

- Idaho Fish and Game: Cooperatively managing the Refuge and WPAs and the Marty tract to preserve winter grounds for elk and mule deer in the area and preserve sage-grouse habitat.

- Pheasants Forever: Management of the recently acquired Marty tract to be managed cooperatively for wildlife.
- North American Grouse Partnership: Upland habitat management partnerships for the benefit and conservation of greater sage-grouse.
- Ducks Unlimited, Inc.: Wetland habitat management partner in restoration of Camas Creek riparian channel and associated wetlands within refuge boundary.
- Audubon Society: Protect, preserve and enhance habitat important to neo-tropical migrants.
- Rocky Mountain Elk Foundation: Partnerships to preserve and enhance elk habitat, esp. wintering grounds.
- Local Photography Clubs: Cooperatively develop a refuge-wide code of photographer's ethics to continue to provide quality wildlife observation experiences, protect sensitive wildlife, and enhance the experience for all who visit the Refuge.
- Continental Divide Cooperative Weed Management Area: Cooperatively using IPM approaches to treat noxious weeds within the Camas/Beaver Creek Watersheds.
- Dubois Grouse Days: Working to preserve sage-grouse and habitat through environmental education and interpretation.
- Upper Snake River sage-grouse Working Group: Preservation of sage-grouse and associated habitat.
- Great Basin LLC: To enhance understanding of the effects of climate change and other natural and human disturbances across the region and promotes coordinated science-based actions to enable human and natural communities to respond and/or adapt to those conditions.
- Friends of Camas NWR: The Refuge Friends Group has "adopted" Camas NWR and advocates for the Refuge's needs, and provides both financial and volunteer support to accomplish many essential tasks and projects.
- State Department of Water Resources: Seeking collaborative solutions to assuring riparian water rights in perpetuity and undertaking habitat restoration efforts within Camas Creek.

Groundwater Pumping and Snake River Aquifer Depletion

The purpose of water right adjudication is to catalog and confirm through the court all water rights and to which property those water rights belong, binding all property owners and parties to the court decree of those water rights. A massive administrative and legal process began in 1987 designed to sort out more than 150,000 individual claims for water rights in the Snake River Basin area.

The State of Idaho administers water rights according to the Prior Appropriation Doctrine. Idaho fully recognized the need to implement conjunctive management of its water resources in 1984 when the Idaho Supreme Court determined that hydropower water rights of Idaho Power Company at Swan Falls Dam were not subordinated to junior upstream irrigation rights. The case alerted water users in the basin that groundwater pumping for irrigation was impacting spring discharge and flow in the Snake River, and that surface and groundwater rights were to be jointly administered. In 1992, a moratorium was imposed on new irrigation pumping on the eastern Snake River Plain (Idaho Department of Water Resources [IDWR] 1996), which is still in place. Subsequently, IDWR promulgated conjunctive management rules to provide a mechanism to stem conflicts between surface and groundwater users when water supplies are limited. IDWR has also formed water measurement districts in the Eastern Snake River Plain that require the measurement and reporting of groundwater pumping at rates exceeding 0.24 cfs, or irrigating areas greater than 5 acres.

Depletion of spring flows and declining groundwater levels are a collective effect of drought, changes in surface-water irrigation acreage and practices, and groundwater pumping. A recent model study (IDWR 1997) indicates that the collective effects of all groundwater pumping within the boundaries of the eastern Snake River Plain depletes spring discharge and flow of the Snake River by about 900,000 acre-feet per year (1,200 cfs). The same study projects that changes in surface water irrigation practices have depleted the spring discharge by about 500,000 acre-feet per year (700 cfs). IDWR and the courts are placed in the position of determining the degree to which junior groundwater users have injured senior surface-water users. Isolating cause and effect relationships on a case by case basis will be difficult and costly.

Although most water users and managers accept the concept that groundwater use depletes surface water supplies, it is not necessarily accepted that depletion constitutes legal injury. The conjunctive management rules provide for weighing the time of year in which depletion is experienced, the efficiency of use of the senior water users, and the maximum economic benefits of all uses, against the possibility of a "futile call."

The State's conjunctive management rules allow junior priority water users to mitigate injury to senior surface and groundwater users. One of the mechanisms is to provide supplemental recharge to the aquifer. Both surface and groundwater users have embraced artificial or managed recharge as a means of avoiding future conflicts and litigation.

Genetically Modified Organisms

Pollen blowing in the wind or carried by pollinator species may be capable of transferring genetically engineered traits, such as herbicide resistance and pest resistance, to closely related wild plants. Genetically engineered plants with weedy wild relatives are of particular concern. If expressed in the genetic background of a weed species, a transgene could increase the fitness of the weed in nature (Stewart et al. 2000). Laboratory studies have shown non-target pollinator species may also be harmed by wind-blown pollen. Monarch butterfly larvae have been shown in both laboratory and field tests (Jesse and Obrycki 2000; Losey et al. 1999) to suffer growth and mortality effects after feeding on milkweed plants dusted by corn pollen that was genetically engineered to express a Bt, a bacterial toxin.

Pesticides

The Refuge can select less toxic pesticides and standardize operational procedures to minimize the immediate and accumulative effect of pesticides in the environment. However, the Refuge has no control over surrounding land-use and agricultural practices, thereby increasing the risk of acute and chronic exposures to wildlife from herbicides. Acute exposure is a single exposure or multiple brief exposures occurring within a short time (e.g., 24 hours or less in humans). Chronic exposures are those that extend over the average lifetime or for a significant portion of the lifetime of the species (USFS 2005). Herbicides from the Refuge would result in a moderate to minor risk from acute chemical exposure. However, unquantified and increasing risks from acute and chronic exposure may occur via the aggregate impacts from refuge herbicide applications when combined with private, county, and State herbicide applications within the Upper Snake River Plain.

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Appendices A-M

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Appendix A. Appropriate Use Determinations

A.1 Introduction

The Appropriate Refuge Uses Policy outlines the process that the Service uses to determine when general public uses on refuges may be considered. Priority public uses previously defined as wildlife-dependent uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation) under the National Wildlife Refuge System Improvement Act of 1997 are generally exempt from appropriate use review. Other exempt uses include situations where the Service does not have adequate jurisdiction to control the activity and refuge management activities.

In essence, the appropriate use policy, 603 FW 1 (2006), provides refuge managers with a consistent procedure to first screen and then document decisions concerning a public use. When a use is determined to be appropriate, a refuge manager must then decide if the use is compatible before allowing it on a refuge. The policy also requires review of existing public uses. During the CCP process the refuge manager evaluated all existing and proposed refuge uses at Camas 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 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 that the following refuge use(s) are appropriate at Camas NWR, and directed that compatibility determinations be completed for each use: agricultural practices (farming and haying); research; dog walking; and non wildlife-dependent recreation (bicycling, cross-country skiing, snowshoeing and jogging).

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FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Camas National Wildlife Refuge

Use: Agricultural Practices

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?	✓	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✓	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✓	
(g) Is the use manageable within available budget and staff?	✓	
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✓	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✓	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** ✓

Refuge Manager:____ Date:______________________

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:____ Date:______________________

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

Appropriate Uses Justification, Attachment 1

Date:

Refuge: Camas National Wildlife Refuge (NWR)

Use: Agriculture (farming and haying) to provide habitat and forage for wildlife

Summary: A variety of agricultural practices have been used on Camas NWR since it was created by Executive Order in 1937. Two of those practices, growing crops and haying of wild or natural vegetation, are still being used today. Currently on the Refuge two separate tracts of 80 acres are farmed through Cooperative Land Management Agreements (CLMA). A total of 140 of these acres are irrigated alfalfa harvested by the cooperator and 20 are grain that is left in the field for wildlife. Our “wild hay” program also includes a cooperator that is managed through a CLMA. The cooperator is allowed to hay 150 acres of wild grasses and in turn either pays cash or provides goods or services to the Service in exchange for the hay.

The primary objective of haying and farming is to manage vegetation to maintain or increase its value to wildlife at a minimal cost to the government. The 20 acres of grain provide a food source on the Refuge for a variety of species including geese, ducks, sandhill cranes, white-tailed deer and elk. The irrigated alfalfa also provides a protein rich food source for these species, and may reduce depredation on adjacent private lands. Haying also provides a short grass habitat that species such as sandhill cranes, Canada geese, greater sage-grouse, and others use for foraging and loafing sites. Haying provides a more economical means of providing this type of habitat than mowing via force account, or prescribed fire.

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?

Yes. All proposed activities would take place within refuge boundaries and under the supervision of refuge staff.

b. Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?

Yes.

c. Is the use consistent with applicable Executive orders and Department and Service policies?

The proposed use would provide high energy and readily available forage and cover for wintering and migrating waterfowl and cranes within close proximity to other natural food sources and high quality resting habitat. Crops can provide wildlife with easily accessible high-energy foods that are more digestible than native plants, and can reduce foraging time required to meet caloric demands (Alisauskas and Ankney 1992; Baldassarre and Bolen 2006; Raveling 1979). Because it would be difficult to meet these conditions by managing natural foods alone, the production of non-genetically modified crops is consistent with the Service’s Biological Integrity, Diversity and Environmental Health Policy (601 FW 3) and would help achieve the refuge purposes.

d. Is the use consistent with public safety?

The proposed use is consistent with public safety and, on Bear Lake NWR, would be sited in areas closed to the general public.

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

In the Draft Comprehensive Conservation Plan (CCP) for Camas NWR, specific goals, objectives and strategies have been established for the farming and haying program at Camas NWR. The planning team decided that the agricultural practices still in place on the Refuge provided benefits to enough wildlife species that they should remain in place at the current acreage.

f. Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?

In 1994 an Environmental Assessment was completed for haying on the Refuge and a subsequent compatibility determination found that the use was compatible. A revised compatibility determination was done on haying and farming in 2005 and both uses were found to be compatible.

g. Is the use manageable within available budget and staff?

The proposed use is manageable with available budget and staff. The use of a cooperator may save staff time and resources and increase the quality of wetland and grassland habitats over what could be achieved by only mowing with refuge staff.

h. Will this be manageable in the future within existing resources?

Yes. This use would continue to be manageable with future resources as long as the acreages being farmed or hayed do not increase dramatically.

i. Does the uses 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 proposed use can contribute to the public's understanding and appreciation of the Refuge because hay and crop fields are situated adjacent to refuge roads where the public can view wildlife.

j. Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?

The proposed use does not and would not impair existing or future wildlife-dependent recreational use of the Refuge. Approximately 20 acres would be used for grain production, 140 acres for alfalfa production, and 150 acres (annually) for hay. These areas are closed to the general public, but viewable from adjacent roads.

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FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Camas National Wildlife Refuge

Use: The use of Research on Refuge lands and waters,

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?	✓	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✓	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✓	
(g) Is the use manageable within available budget and staff?	✓	
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✓	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✓	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** ✓

Refuge Manager:____ Date:_____________________

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:____ Date:_____________________

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

Appropriate Uses Justification, Attachment 2

Date:

Refuge: Camas National Wildlife Refuge (NWR)

Use: 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 outline: 1) study objectives; 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 Refuge, if any; and 7) end products (i.e., reports, publications). Research proposals would be reviewed by refuge staff and others as appropriate prior to the issuance of a special use permit (SUP). Projects would not be open-ended, and at a minimum, would 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?

The Refuge has jurisdiction over those research projects that are sited within the Refuge's boundaries.

b. Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?

All approved research activities would comply with all applicable laws and regulations. A SUP would be issued, with stipulations and restrictions to ensure compliance with relevant laws and regulations.

c. Is the use consistent with applicable Executive orders and Department and Service policies?

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

d. Is the use consistent with public safety?

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

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

Research activities are approved in instances where they can provide meaningful data that may contribute to refuge management and public appreciation of natural resources.

f. Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?

This is the first time the use has undergone an appropriate use determination although research has occurred on the Refuge since establishment. Currently, research projects are reviewed and approved individually to ensure compliance law and policy (Research on Service Lands Policy, 803 FW 1).

g. Is the use manageable within available budget and staff?

The Refuge receives less than four research requests per year. Only projects that are manageable within the current budget and staffing would be approved.

h. Will this be manageable in the future within existing resources?

The proposed activity at current levels would be manageable in the future with the existing resources (see above).

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?

The proposed use is beneficial to the Refuge's natural and cultural resources because the types of research projects approved are those which are likely to help the Refuge achieve its purposes by providing information useful for the management of trust resources, and may contribute to the public's understanding and appreciation of natural and/or cultural resources.

j. Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?

The Refuge would ensure that the research activities would not impair existing or future wildlife-dependent recreational use of the Refuge during individual project review, prior to issuing a SUP for the project.

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FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Camas National Wildlife Refuge

Use: Dog Walking

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?	✓	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✓	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?		✓
(g) Is the use manageable within available budget and staff?	✓	
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?	✓	
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✓	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate** ✓

Refuge Manager:____ Date:______________________

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:____ Date:______________________

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

Appropriate Uses Justification, Attachment 3

Date:

Refuge: Camas National Wildlife Refuge (NWR)

Use: Dog walking

Summary: Dog walking is currently allowed on the Refuge as long as the dog is on a leash or under close control of the owner and is in an area where public use is allowed. Dog walking is an occasional use on Camas NWR and is spread out from spring to fall. Overall visitation to the Refuge is relatively low (estimated at 6,000 to 7,000 visits per year) and based upon staff observations a very small portion of these visitors bring pets. The uses associated with dogs seem to be biking and hiking. Few waterfowl and upland game bird hunters use the Refuge, so use of dogs for hunting is currently minimal. This use is considered appropriate, with stipulations to reduce wildlife disturbance and ensure public safety.

For findings listed on FWS Form 3-2319 and if deemed necessary a justification has been provided below:

a. Do we have jurisdiction over the use?

Yes.

b. Does the use comply with applicable laws and regulations?

Yes.

c. Is the use consistent with applicable Executive orders and Department and Service policies?

Yes.

d. Is the use consistent with public safety?

Dogs have the potential to present a safety hazard to others visitors, especially if they are not properly controlled by the owner. Uncontrolled dogs that are not conditioned to be around strangers pose a potential risk to unsuspecting visitors.

The Refuge’s relatively low visitation, combined with the fact that, based upon staff observations, very few visitors actually bring dogs to the Refuge, suggests that interaction between dogs and visitors other than their owners would be infrequent. Requiring dogs to be under close control, via leash or an electronic collar, will also reduce the risk of negative interactions with visitors to the Refuge.

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

Yes.

f. Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?

Currently dogs are allowed on the Refuge, and the current refuge brochure reads: “Pets are allowed if on leash or under close control.” However, a compatibility determination has not been done for this use. Use of dogs for waterfowl and upland game bird hunting is considered in the compatibility determinations for those uses.

g. Is the use manageable within available budget and staff?

Yes. Given the current and projected public use on the Refuge this use is manageable with available budget and staff. Management of this use would likely occur when staff is involved with other projects on the Refuge.

h. Will this be manageable in the future within existing resources?

Yes (see above).

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?

Although dog-walking is not strictly being performed to understand or appreciate the wildlife on the Refuge, it is likely some visitors like to see and enjoy the Refuge and its wildlife while exercising their pets.

j. Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1 for description), compatible, wildlife-dependent recreation into the future?

Several studies indicate that the presence of dogs (even if on a leash) increase disturbances to wildlife, compared to people that are not accompanied by dogs (Hoopes 1993; MacArthur et al. 1982). Unrestrained dogs also may kill, chase, or harass wildlife. Therefore, dogs can interfere with the ability of wildlife to feed and rest, as well as interfere with the experiences of other visitors who come to see or photograph wildlife. At the current levels of visitation and the low number of dogs brought to the Refuge, this use can be accommodated with minimal impacts to wildlife, and without impairing existing wildlife-dependent recreational uses. If visitation or the number of dogs being brought to the Refuge dramatically increases in the future, the Refuge will need to re-evaluate the use for appropriateness and compatibility.

Literature Cited

Hoopes E.M. 1993. Relationships between human recreation and piping plover foraging ecology and chick survival. M.S. thesis. University of Massachusetts, Amherst, MA. 106 pp.

MacArthur, R.A., V. Geist, and R.H. Johnston. 1982. Cardiac and behavioral responses of mountain sheep to human disturbance. Journal of Wildlife Management 46:351-358.

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FINDING OF APPROPRIATENESS OF A REFUGE USE

Refuge Name: Camas National Wildlife Refuge

Use: Bicycling, jogging, cross-country skiing, and snow shoeing

This form is not required for wildlife-dependent recreational uses, take regulated by the State, or uses already described in a refuge CCP or step-down management plan approved after October 9, 1997.

Decision Criteria:	**YES**	**NO**
(a) Do we have jurisdiction over the use?	✓	
(b) Does the use comply with applicable laws and regulations (Federal, State, tribal, and local)?	✓	
(c) Is the use consistent with applicable Executive orders and Department and Service policies?	✓	
(d) Is the use consistent with public safety?	✓	
(e) Is the use consistent with goals and objectives in an approved management plan or other document?	✓	
(f) Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?	✓	
(g) Is the use manageable within available budget and staff?	✓	
(h) Will this be manageable in the future within existing resources?	✓	
(i) Does the use contribute to the public's understanding and appreciation of the refuge's natural or cultural resources, or is the use beneficial to the refuge's natural or cultural resources?		✓
(j) Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1, for description), compatible, wildlife-dependent recreation into the future?	✓	

Where we do not have jurisdiction over the use ("no" to (a)), there is no need to evaluate it further as we cannot control the use. Uses that are illegal, inconsistent with existing policy, or unsafe ("no" to (b), (c), or (d)) may not be found appropriate. If the answer is "no" to any of the other questions above, we will **generally** not allow the use.

If indicated, the refuge manager has consulted with State fish and wildlife agencies. Yes ✓ No ___

When the refuge manager finds the use appropriate based on sound professional judgment, the refuge manager must justify the use in writing on an attached sheet and obtain the refuge supervisor's concurrence.

Based on an overall assessment of these factors, my summary conclusion is that the proposed use is:

Not Appropriate_____ **Appropriate**✓

Refuge Manager:____ Date:______________________

If found to be **Not Appropriate**, the refuge supervisor does not need to sign concurrence if the use is a new use.

If an existing use is found **Not Appropriate** outside the CCP process, the refuge supervisor must sign concurrence.

If found to be **Appropriate**, the refuge supervisor must sign concurrence.

Refuge Supervisor:____ Date:______________________

A compatibility determination is required before the use may be allowed.

FWS Form 3-2319
02/06

Appropriate Uses Justification, Attachment 4

Date:

Refuge: Camas National Wildlife Refuge (NWR)

Use: Bicycling, jogging, cross-country skiing, snowshoeing

Summary: Bicycling and jogging currently occur infrequently on Refuge roads. A local bicycling group uses the Refuge for one ride per year. Because jogging, and use of bicycles, are limited to the road system, which limits disturbance of wildlife, and because of the infrequency of these uses, bicycling and jogging have been determined to be appropriate. Cross-country skiing and snowshoeing have also been allowed on Refuge roads. This use is very infrequent and is dependent upon having enough snow to make the use feasible. This use also occurs in winter when most of our wildlife species have moved further south. Due to the low occurrence of these uses and the limited amount of wildlife on the Refuge during this period, snowshoeing and cross-country skiing have been determined to be appropriate.

For findings listed on FWS Form 3-2319 and if deemed necessary a justification has been provided below:

a. Do we have jurisdiction over the use?

Yes

b. Does the use comply with applicable laws and regulations?

Yes

c. Is the use consistent with applicable Executive orders and Department and Service policies?

Yes

d. Is the use consistent with public safety?

Bicycling, jogging, cross-country skiing, and snowshoeing are infrequent uses on Camas NWR. Management has no observations or reports of conflicts with vehicle traffic, pedestrians, or wildlife.

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

Bicycling, jogging, cross-country skiing, and snowshoeing are consistent with Refuge goals and objectives as long as they are restricted to refuge roads, group size is limited, and they remain infrequent uses.

f. Has an earlier documented analysis not denied the use or is this the first time the use has been proposed?

This is the first time these uses have undergone an appropriate use determination, although the uses have traditionally occurred infrequently.

g. Is the use manageable within available budget and staff?

Refuge staff has not had to put any extra time or effort into managing these uses due to their low frequency. Therefore, these uses are currently manageable within available budget and staff.

h. Will this be manageable in the future within existing resources?

At current levels, the proposed activity would be manageable in the future with the existing resources (see above).

i. Does the uses 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?

Generally bicycling and jogging are performed for exercise and enjoyment. Although participants may find these activities more enjoyable when done in a natural setting, these uses would not be expected to contribute to the public's understanding and appreciation of natural and cultural resources. However, because the Refuge has graveled (not paved) roads, bicyclists move at a relatively slow pace. Those bicycling strictly for exercise would probably not use the Refuge for that function. It may be postulated that bicyclists coming to the Refuge are doing so to enjoy nature and watch wildlife, in addition to exercise. Because staff interactions with bicyclists and joggers occur so infrequently, no data are currently available to determine their actual motivations.

Snowshoeing is a leisurely activity that is conducive to stopping and watching winter wildlife. Because the Refuge is basically flat, cross-country skiing is also a leisurely activity, although faster paced than the snowshoeing. Cross-country skiing also lends itself to stopping and enjoying wildlife.

j. Can the use be accommodated without impairing existing wildlife-dependent recreational uses or reducing the potential to provide quality (see section 1.6D, 603 FW 1 for description), compatible, wildlife-dependent recreation into the future?

At the present time bicycling and jogging, due to their infrequency, are not impairing existing wildlife-dependent recreational uses. These uses should be carefully monitored to reassess appropriateness before the use increases to the point of causing conflicts with wildlife and other visitors.

Due to relatively low numbers of visitors participating in snowshoeing and cross-country skiing, and the fact that they occur in winter when wildlife numbers and wildlife-dependent recreation visitors are at their lowest, these activities can be accommodated without impairing other uses.

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Appendix B. Compatibility Determinations

B.1 Introduction

The compatibility determinations (CDs) developed during the CCP planning process evaluate uses projected to occur under Alternative 2, the Preferred Alternative in the Draft CCP/EA for the Camas National Wildlife Refuge.

The evaluation of funds needed for management and implementation of each use also assumes implementation as described under Alternative 2. Chapter 6 of the Draft CCP/EA also contains analysis of the impacts related to public use, wildlife, and habitats.

B.2 Uses Evaluated at This Time

The following section consists of CDs for all refuge uses that are required to be evaluated at this time. According to U.S. Fish and Wildlife Service (USFWS; Service) policy, compatibility determinations would be completed for all uses proposed under a CCP. Existing wildlife-dependent recreational uses must also be re-evaluated and new CDs prepared during development of a CCP or every five years, whichever comes first. Uses other than wildlife-dependent recreational uses are not explicitly required to be re-evaluated 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 ten 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.

Refuge Use	Compatible	Next Year Due for Re-evaluation
Camas NWR		
Environmental Education, Interpretation, Wildlife Observation, and Photography	Yes	2029
Migratory Bird Hunting	Yes	2029
Upland Game Bird Hunting	Yes	2029
Big Game (Elk) Hunting	Yes	2029
Research	Yes	2024
Agricultural Practices	Yes	2024
Dog Walking	Yes	2024
Non-Wildlife-Dependent Recreation (Bicycling, Jogging, Cross-Country Skiing, Snowshoeing)	Yes	2024

B.3 Compatibility—Legal and Historical Context

Compatibility is a tool refuge managers use to ensure that recreational and other uses do not interfere with wildlife conservation, the primary focus of refuges. Compatibility is not new to the Refuge System; the concept dates back to 1918. 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." If a general public use is determined to be appropriate, the use must then undergo a compatibility review. A compatibility review is required for all appropriate public uses, including wildlife-dependent recreational uses.

The term "compatible use" is defined as a wildlife-dependent recreational use or any other use of a refuge that, in the sound professional judgment of the refuge manager, would not materially interfere with or detract from the fulfillment of the mission of the Refuge System or the purposes of the refuge.

The Administration Act defines sound professional judgment as a finding, determination, or decision that is consistent with principles of sound fish and wildlife management and administration, available science and resources, and adherence to other applicable laws. Included in this finding, determination, or decision is a refuge manager's field experience and knowledge of the particular refuge's resources.

Part 603 FW 2 of the Fish and Wildlife Service Manual sets forth the policy and guidelines for determining compatibility of proposed uses and provides procedures for documentation and periodic review of existing uses. In addition, the policy requires an opportunity for public review and comment on all compatibility determinations. When prepared in conjunction with a CCP, compatibility determinations are distributed for public review along with the draft CCP and environmental assessment (EA).

Under compatibility policy, uses are defined as recreational, economic/commercial, or management use of a refuge by the public or a non-Refuge System entity. Uses generally providing an economic return (even if conducted for the purposes of habitat management) are also subject to compatibility determinations. The Service does not prepare compatibility determinations for uses when the Service does not have jurisdiction. For example, the Service may have limited jurisdiction over refuge areas where property rights are vested by others; where legally binding agreements exist; or where there are treaty rights held by tribes. In addition, aircraft over-flights, emergency actions, some activities on navigable waters, and activities by other Federal agencies on "overlay refuges" are exempt from the compatibility review process.

New compatibility policy, developed in response to the 1997 amendments to the National Wildlife Refuge System Administration Act (Administration Act), was adopted by the Service in October 2000 (U.S. Fish and Wildlife Service 2000). The policy requires 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 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 1997). Evaluations of the existing uses on Camas NWR are based on the professional judgment of refuge personnel including observations of refuge uses and reviews of appropriate scientific literature.

The refuge manager has the authority to determine, by exercising sound professional judgment, what is a compatible use. In addition to determining if a use would materially interfere with or detract from the fulfillment of the System mission or the purposes of the refuge, the refuge manager must also evaluate the direct and indirect impacts of a use on refuge resources. Further, the cumulative impacts of the use when conducted in conjunction with other existing or planned uses of the refuge must also be considered. After evaluating the anticipated impacts of a proposed use and determining if any stipulations (terms or conditions) are needed to avoid or minimize potential adverse impacts, the refuge manager would determine whether or not the use is compatible. This determination is documented in writing and is available for review by the public.

A proposed use can be denied without determining compatibly under certain circumstances, such as instances in which:

1. A proposed use would conflict with other applicable laws or regulations;
2. The use would result in conflicts with the goals or objectives of an approved CCP; or
3. A use is determined to be inconsistent with public safety.

Refuges are closed to all public uses until officially opened. Regulations require that adequate funds be available for administration and protection of refuges before opening them to any public uses. However, wildlife-dependent recreational uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation) are to receive enhanced consideration and cannot be rejected simply for lack of funding resources unless the refuge has made a concerted effort to seek out funds from all potential partners. Once found compatible, wildlife-dependent recreational uses are deemed the priority public uses at a refuge. If a proposed use is found not compatible, the use must be modified to be compatible or if the use cannot be modified to be compatible, then the use may not be allowed. Economic uses that are conducted by or authorized by the refuge also require compatibility determinations.

References

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

U.S. Fish and Wildlife Service. 2000. National Wildlife Refuge System Policies. Compatibility regulations adopted by the Service in October 2000. Available at: http://refuges.fws.gov/policymakers/nwrpolicies.html.

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B.4 Draft Compatibility Determination for Wildlife Observation and Photography, Interpretation, and Environmental Education on Camas National Wildlife Refuge

RMIS Database Uses: Wildlife Observation, Wildlife Photography, Interpretation, and Environmental Education

Refuge Name: Camas National Wildlife Refuge (NWR)

Location: Jefferson County, Idaho

Date Established: 1937

Establishing and Acquisition Authorities:
- Executive Order 7720, signed October 8, 1937, dated October 8, 1937
- Migratory Bird Conservation Act of 1929, as amended (16 U.S.C. § 715 et seq.)
- National Wildlife Refuge System Administration Act (16 U.S.C. § 668dd et seq.)

Refuge Purpose(s):

- "… as a refuge and breeding ground for migratory birds and other wildlife." (Executive Order 7720, dated Oct. 8, 1937)
- "… for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. § 715d (Migratory Bird Conservation Act)
- "… conservation, management, and … restoration of the fish, wildlife, and plant resources and their habitats … for the benefit of present and future generations of Americans… " 16 U.S.C. § 668dd(a)(2) (National Wildlife Refuge System Administration Act)

National Wildlife Refuge System Mission:

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

Description of Use(s):

Non-consumptive wildlife-dependent recreation (defined here as wildlife observation, photography, environmental education and interpretation) are designated as priority public uses under the Refuge Improvement Act and can enhance the users' appreciation of the Refuge, the National Wildlife Refuge System, wildlife, their habitats, and the human environment.

Current Use:

Currently, most use is self-guided and occurs on roads and trails. Due to the often harsh and long winters in the Camas area, most of this use occurs during the late spring, summer, and early fall, although winter viewing of bald eagles at their roost near refuge headquarters also occurs. An estimated 6,000-7,000 people visit the Refuge annually; of these, most are engaged in wildlife observation and photography, while an estimated 400-500 visitors engage in interpretation and environmental education (tour participants, and school and Scout groups). Wildlife photography and observation are self-conducted activities and are facilitated through the availability of the 6.3-mile Auto Tour Route with nine pullouts and associated interpretive panels; 27 miles of dirt/gravel service roads; a 0.5-mile Architectural Barriers Act (ABA)-accessible trail with viewing platform overlooking Camas Creek; a small visitor contact station at the refuge office; and an orientation kiosk, restrooms, and parking located adjacent to the refuge office. Wildlife viewing tours are conducted occasionally by the refuge manager upon request.

The 6.3-mile, two-way Auto Tour Route (ATR) is open to vehicle, pedestrian (hiking, jogging, cross-country skiing, and snowshoeing), and bicycle traffic year round, although it may be impassable in winter. Based upon data gathered from a vehicle traffic counter installed on the ATR in 2009, from 50 to 370 vehicles used the ATR per month, with the peak occurring from March to June. An additional 6.5 miles of roads leading to, and within the Refuge's waterfowl and upland game hunt units are open to vehicles and pedestrian traffic during the waterfowl and upland game bird hunting seasons (Sept 21-Jan 31). These roads are not maintained throughout the winter, and therefore, may be impassable at times.

The 0.5-mile birding trail is open year round to pedestrian use only, however, most use is spring through early fall. Hiking, jogging, bicycling, cross-country skiing, and snowshoeing are permitted year round on an additional 27 miles of dirt and gravel service roads that are un-maintained and ungroomed in winter. Off-road hiking is permitted throughout the entire Refuge from July 15-February 28.

The auto tour route, parking lot, and pedestrian trail/viewing platform are open daily from ½ hour before sunrise to ½ hour after sunset throughout the year. Any refuge public use programs or activities that may require access after sunset or before sunrise are managed by the refuge staff and may require Special Use Permits.

Interpretation includes activities and infrastructure that explain management activities, fish and wildlife resources, ecological processes and cultural history to the visiting public. This information is provided through interpretive signs at the informational kiosk and on the Auto Tour Route, brochures, and infrequent scheduled tours or talks led by refuge staff and/or volunteers. These tours reach 150-200 participants annually.

Currently, environmental education programs are limited and conducted for local school and Scout groups upon request, reaching an estimated 250 students annually.

Proposed Use:

The Refuge would maintain facilities for self-guided wildlife observation and photography, including the 6.3-mile Auto Tour Route, visitor contact station, information kiosk, restrooms, and paved parking lot. The 0.5-mile pedestrian birding trail would be lengthened to 1.3 miles. Vehicle access would continue to be allowed year round on the Auto Tour Route, except that the route would be changed to one-way to promote visitor safety. 6.5 miles of additional roads leading to and within the north and south waterfowl and upland game bird hunt units would continue to be open to vehicle and pedestrian traffic during hunting seasons. To promote visitor safety and limit disturbance to wildlife, we propose to eliminate free-roam hiking in the Preferred Alternative. Hiking, jogging, bicycling, cross-country skiing, and snowshoeing would continue to be allowed year round, weather and conditions permitting, on the Refuge's 6.3-mile auto tour route and 27 miles of service roads, including 5 miles of service roads within the elk hunting area. Photographers would be allowed to place their portable blinds within 100 feet of roads. No more than five portable photo blinds would be allowed on the Refuge at any given time. Blind space must be reserved in advance.

Additional opportunities for wildlife observation, photography, environmental education, and interpretation would be provided under the Preferred Alternative, via an increased number of wildlife viewing tours and an enhanced environmental education program conducted by refuge staff, volunteers, teachers, or other leaders. These programs would assist in the development of the skills and understanding to make informed decisions regarding natural resource management and encourage participation in resource management and protection. Environmental education classes or events would be scheduled by the refuge staff and/or volunteers. Eight wildlife viewing tours (200-300 participants annually) and ten to fifteen educational tours (800 students annually within ten years) would be conducted annually by refuge staff and volunteers. Funding would be sought for a new Visitor Contact station and EE classroom to support these enhanced programs.

Need and Availability of Resources:

Category and Itemization	One-time ($000)	Annual ($000/yr)
New visitor contact station/EE classroom	$350,000	
Extension of birding trail	$25,000	
Additional interpretive and administrative signs	$10,000	
New refuge brochures and/or tear sheets, website, other digital products	$8,500	
Salary for dedicated Park Ranger/Visitor Services Manager position		$75,000
Salary for Complex Visitor Services/Volunteer Coordinator position (.25 FTE)		$18,750
Maintenance of public use facilities (roads, trails, parking lots, restrooms, exhibits)		$5,500
Other program operations (administration and management, law enforcement, biological monitoring		$25,000
TOTAL	$393,500	$124,250

Once the CD is approved through the CCP process, Federal funds would be requested through the Service budget process. Other sources (monetary and non-monetary) would be sought through strengthened partnerships, grants, coordination with other agencies, and additional refuge operations funding to support a safe, quality public use program. Existing staff and resources are not currently adequate to meet the potential need for environmental education opportunities that exist in the area. A staff member dedicated to this purpose would greatly increase the number of participants in this use on Camas NWR. The use of volunteer assistance has been initiated and has had a positive impact on the number of students visiting Camas NWR. Increased volunteer assistance, strengthened existing partnerships, and new partnerships would be sought to support environmental education and interpretation programs in an effective, safe, and compatible manner. Refuge staff would increase volunteer recruiting efforts. Volunteers, interns, and various user groups when provided appropriate training can assist the Refuge with monitoring, education and interpretation programs, and maintenance projects. With additional assistance as described above, staffing and funding is expected to be sufficient to manage these uses.

Anticipated Impacts of the Use(s):

Impacts resulting from the proposed use include both direct and indirect impacts to wildlife resources and the associated habitat. Direct impacts have an immediate effect on wildlife and generally result from the public's interaction with wildlife. Indirect impacts would include actions taken by the public that would impact habitat or reduce access to habitat.

Effects to Habitat:

The primary impact visitors engaged in wildlife observation and photography have on habitat is the trampling of vegetation and creation of social trails. Trail widening and creation of social trails increases the area of disturbed land (Adkison and Jackson 1996; Dale and Weaver 1974; Liddle 1975). Pedestrians can potentially cause structural damage to plants and increase soil compaction and erosion (DeLuca et al. 1998; Whittaker 1978). These impacts are unlikely to occur on the well-defined, gravel surface of refuge trails; however, social trails associated with off-trail use remain an issue for refuge managers as plants are trampled and wildlife is disturbed. Control of invasive plant species on the Refuge is a difficult and never-ending battle. Roads and trails often function as conduits for movement of plant species, including non-native, invasive species (Benninger-Truax et al. 1992; Hansen and Clevenger 2005). Propagules of non-native plants can be transported into new areas on hikers' boots, clothing, and equipment (Benninger-Traux et al. 1992). Once established, invasive plants can out-compete native plants, thereby altering habitats and indirectly impacting wildlife. Invasive plants and animals would be controlled and monitored as part of the Refuge's Integrated Pest Management Plan.

Effects to Wildlife:

Anticipated direct impacts include disturbance to wildlife by human presence which typically results in a temporary displacement of individuals or groups. Immediate responses by wildlife to recreational activity can range from behavioral changes including nest abandonment, altered nest placement, change in food habits, physiological changes such as elevated heart rates and increased energetic costs due to flight or flushing, or even death (Belanger and Bedard 1990; Knight and Cole 1995; Knight and Swaddle 2007; Miller et al. 1998; Miller and Hobbs 2000; Morton et al. 1989; Smith-Castro and Rodewald 2010). The long-term effects are more difficult to assess but may include altered behavior, vigor, productivity or death of individuals; altered population abundance, distribution, or demographics; and altered community species composition and interactions.

According to Knight and Cole (1991), there are three wildlife responses to human disturbance: 1) avoidance; 2) habituation; and 3) attraction. The magnitude of the avoidance response may depend on a number of factors including the type, distance, movement pattern, speed, and duration of the disturbance, as well as the time of day, time of year, weather; and the animal's access to food and cover, energy demands, and reproductive status (Fernandez-Juricic et al. 2007; Gabrielsen and Smith 1995; Knight and Cole 1991).

Habituation is defined as a form of learning in which individuals stop responding to stimuli that carry no reinforcing consequences for the individuals that are exposed to them (Alcock 1993). A key factor for predicting how wildlife would respond to disturbance is predictability. Often, when a use is predictable—following a trail or boardwalk or at a viewing deck—wildlife would habituate to and accept human presence (Oberbillig 2000). Gabrielsen and Smith (1995) suggest that most animals seem to have a greater defense response to humans moving unpredictably in the terrain (e.g., off-trail hikers) than to humans following a distinct path.

Direct impacts: Negative impacts to wildlife have been documented when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Response of birds to human activities includes departure from site (Burger 1981; Henson and Grant 1991; Klein 1993; Korschgen et al. 1985; Owens 1977; Taylor and Knight 2003), use of suboptimal habitat (Erwin 1980; Williams and Forbes 1980), altered behavior (Burger 1981; Havera et al. 1992; Klein 1993; Korschgen et al. 1985; Morton et al. 1989; Ward and Stehn 1989), and increase in energy expenditure (Belanger and Bedard 1990; Morton et al. 1989). McNeil et al. (1992) found that many waterfowl species avoid disturbance by feeding at night instead of during the day.

The location of recreational activities impacts species in different ways. Miller et al. (1998) found that nesting success was lower near recreational trails, where human activity was common, than at greater distances from the trails. Stolen (2003) found that the proximity of wading birds to a roadway influenced the probability that a given bird would flush. Migratory waterfowl at J.N. "Ding" Darling NWR remained more than 80 meters (m; 262 feet) from the auto tour route, even when human visitation was low (Klein 1995).

Wildlife species also vary in their sensitivity to disturbance. Klein (1989) found that migratory dabbling ducks to be the most sensitive to disturbance, and that migrant ducks were more sensitive when they first arrived, in the late fall, than later in winter. She also found gulls and sandpipers to be apparently insensitive to human disturbance, with Burger (1981) finding the same to be true for various gull species. However, while gulls are relatively insensitive to disturbance while foraging away from breeding colonies, they can be extremely sensitive to human disturbance at nesting sites. Guay (1968) found that Franklin's gulls are particularly sensitive to human disturbance early in the breeding cycle and again during the chick phase, and would abandon with excessive human exposure. Likewise, Burger (1981) found that wading birds were extremely sensitive to disturbance in the northeastern United States. Disturbance during critical times in the breeding cycle may cause colony abandonment in colonial-nesting waterbirds. White-faced ibis are susceptible to colony abandonment resulting from human intrusion into colonies during the early nesting period (Ryder and Manry 1994). Abandonment of nests is less likely with young than eggs but may still occur with repeated disturbance (Burger and Gochfeld 1994).

Gutzwiller et al. (1997) found that singing behavior of some songbirds was altered by low levels of human intrusion. Resident waterbirds that are regularly exposed to human disturbance tend to be less sensitive than migrants, especially when migrants first arrive at a site (Klein 1993). In areas where human activity is common, birds tolerated closer approaches than in areas receiving less activity. Knight and Cole (1991) also suggested that sound may elicit a much milder response from wildlife if animals are visually buffered from the disturbance.

Pedestrian travel can impact normal behavioral activities, including feeding, reproductive, and social behavior. Studies have shown that ducks and shorebirds are sensitive to pedestrian activity (Burger 1981, 1986). A number of species have shown greater reactions when pedestrian use occurred off trail (Miller et al. 1998; Taylor and Knight 2003). Wildlife photographers tend to have larger disturbance impacts than those viewing wildlife since they tend to approach animals more closely (Klein 1993; Morton 1995). Burger (1999 as cited by Oberbillig 2000) suggests that viewing distances that minimize disturbance can serve as useful guides for managers lacking good site-specific information and serve as a starting point in determining what is appropriate elsewhere. Some factors that affect viewing distances include the numbers of viewers, the time of day, and noise level. When exposing nonbreeding waterbirds to four types of human disturbances (walking, all-terrain vehicle, automobile, and boat), Rodgers and Smith (1997) concluded that a buffer zone of 100 m (328 feet) would minimize disturbance to most species of waterbirds.

The use of the auto tour route, roads, trail, and associated facilities on the Refuge provides potential for human disturbance of wildlife. A good way to control the impacts of non-consumptive wildlife-dependent uses is to mitigate the effect on wildlife by managing these uses in time and space. To minimize disturbance to wildlife, the Refuge would only be open from ½ before sunrise to a ½ hour after sunset. Wildlife observation and photography, interpretation, and environmental education would be allowed only on the 1.3-mile pedestrian trail, the 6.3-mile Auto Tour Route and 27 miles of dirt and gravel service roads (year round). Vehicles would be allowed only on the access road, 6.3-mile Auto Tour Route year round, and 6.5 miles of additional roads leading to the north and south waterfowl hunt unit during the hunting season. The existing auto tour route, roads and trail are located at a sufficient distance from important wildlife use areas that minimal disturbance would occur. Off-road hiking would be prohibited, and the use of portable photography blinds would be limited to a maximum of five blinds on the Refuge at any given time, with all blinds within 100 feet of roads. Refuge staff would manage group size, timing, and location of formal interpretive and environmental education programs to minimize disturbance. Wildlife tours and school groups would be led by refuge staff or trained volunteers to minimize disturbance or other impacts to wildlife.

Cumulative and indirect/secondary impacts: Indirect impacts of wildlife-dependent activities depend on a number of variables, such as season of use, duration of activity, location and number of users. People can be vectors for invasive plants by moving seeds or other propagules from one area to another. Once established, invasive plants can out-compete native plants, thereby altering habitats and indirectly impacting wildlife. The threat of invasive plant establishment would always be an issue requiring annual monitoring and treatment when necessary. Refuge staff would work at eradicating invasive plants and educating the visiting public. Providing and maintaining access points to the Refuge indirectly impacts wildlife by creating barriers to movement, through vegetation removal and management, and abrupt edge creation that may lead to increased predation (Ratti and Reese 1988). Trail edges may concentrate prey species and may be used by predators as travel corridors. Other indirect impacts may include trampling of vegetation, erosion, littering, removal of vegetation, and vandalism. These adverse impacts are expected to be short term and limited to locations along the auto tour route, roads, trail, parking/pullouts, and associated facilities.

Despite the potential for the above effects to result from public visitation, the physical impacts, disturbance to wildlife and habitat, and disturbances on the Refuge are expected to be intermittent, minor, and short term, and in the context of the amount of the Refuge closed to public use (sanctuary) allowing these uses on the Refuge are not expected to diminish the value of the Refuge for its stated purposes.

Summary and application to Camas NWR: Since Camas provides important breeding habitat for migratory waterfowl and waterbirds, the primary concern on Camas NWR would be disturbance to wildlife (especially waterfowl and waterbirds) during the nesting and brood-rearing season, which coincides with the peak season for public use on the Refuge (March-June). In addition there are concerns regarding disturbance to waterfowl, waterbirds, and landbirds during migration, and to bald eagles at their winter roost in the cottonwoods near the refuge headquarters. Most wildlife observation and photography takes place on the Auto Tour Road, the refuge entrance road, and the

1.3 mile pedestrian birding trail. In the seasonally open waterfowl and upland game hunting areas of the Refuge (2,510 acres), access for wildlife observation and photography, interpretation, and environmental education would be restricted to pedestrian and vehicle use of 6.5 miles of service roads on and leading to the north and south waterfowl and upland game hunting units during the hunting season. Confining pedestrian and vehicle access to designated roads and trails, and prohibiting off-road hiking allows wildlife to habituate to the presence of humans.

Public Review and Comment:

Public review and comments are being solicited in conjunction with release of this Draft CCP/EA (USFWS 2013) in order to comply with the National Environmental Policy Act and with Service policy.

Determination: (check one below)

___ Use is Not Compatible

_X_ Use is Compatible with the Following Stipulations

Stipulations Necessary to Ensure Compatibility:

- Activities associated with this proposed use are restricted to those portions of the Refuge that are open to the general public during daylight hours.
- Adherence to seasonal use restrictions to reduce disturbance to nesting waterfowl and other wildlife.
- Vehicle access is allowed only on the entrance road (year round), Auto Tour Route (year round) and designated hunter access roads (open during hunting seasons only). Only street legal vehicles, as defined under Idaho regulations, and bicycles are allowed on the auto tour route and hunter access roads.
- Hiking, bicycling, jogging, cross-country skiing, snowshoeing, and dog walking (on leash only) are allowed year round, and only on the Auto Tour Route and 27 miles of designated service roads. Pedestrian use only allowed on the birding trail. Dogs are prohibited.
- Portable blinds for the purposes of wildlife observation and photography may be used. They must be placed no further than 100 feet from roadways and must be removed at the end of the day.
- A maximum of five portable blinds would be allowed on the Refuge daily. Blinds space must be reserved in advance.
- Camping, overnight use, and fires are prohibited.
- Littering is prohibited.
- Harassment of wildlife or excessive damage to vegetation is prohibited.
- Collection of plants and animals is prohibited unless a Special Use Permit is obtained from the Refuge (except wildlife captured while engaged in fishing and hunting).
- Activities requiring off road/trail access or access between ½ hour after sunset and ½ hour before sunrise would require a Special Use Permit or be managed by refuge staff.
- The Refuge would provide signs and brochures. These materials would clearly state pertinent refuge-specific regulations. Verbal instructions from refuge staff would promote appropriate use of trails and blinds to minimize wildlife and habitat disturbance.

- The Refuge would periodically monitor and evaluate sites and programs to determine if objectives are being met and the resource is not being degraded.

Justification:

Wildlife photography, observation, interpretation, and environmental education are listed as priority wildlife-dependent uses for the National Wildlife Refuge System through which the public can develop an appreciation for fish and wildlife (Executive Order 12996, March 25, 1996 and the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57). The Service's policy is to provide expanded opportunities for wildlife-dependent uses when compatible and consistent with sound fish and wildlife management and to ensure that they receive enhanced attention during planning and management. Facilitating these uses on the Refuge would increase visitor knowledge and appreciation of fish and wildlife resources. This enhanced understanding would foster increased public stewardship of natural resources and support for the Service's management actions in achieving the refuge purposes and the mission of the National Wildlife Refuge System.

There is more than an adequate amount of undisturbed habitat available to the majority of waterfowl, waterbirds, and other wildlife for escape and cover, such that their abundance and use of the Refuge would not be measurably lessened from allowing wildlife observation and photography, interpretation, and environmental education to occur. There is no evidence that these uses at current participation levels materially interfere with the purposes of the Refuge. Stipulations would help reduce or eliminate any unwanted impacts of these uses. The relatively limited number of individual animals expected to be adversely affected due to these uses would not cause wildlife populations to materially decline, the physiological condition and production of wildlife species would not be impaired, their behavior and normal activity patterns would not be altered dramatically, and their overall welfare would not be negatively impacted. Thus, allowing wildlife observation and photography, interpretation, and environmental education would not materially interfere with or detract from the mission of the National Wildlife Refuge System or the purposes for which the Refuge was established.

Mandatory 10- or 15-Year Re-evaluation Date: (provide month and year for "allowed" uses only)

2029 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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Signatures for Compatibility Determination 1, Wildlife Observation, Photography, Environmental Education, and Interpretation at Camas NWR:

Prepared by: ______________________________ ________
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: ______________________________ ________
(Signature) (Date)

Concurrence

Refuge Supervisor: ______________________________ ________
(Signature) (Date)

Regional Chief,
National Wildlife
Refuge System (for
HI, ID, OR,
PI, and WA): ______________________________ ________
(Signature) (Date)

B.5 Draft Compatibility Determination for Waterfowl Hunting on Camas National Wildlife Refuge

RMIS Database Uses: Waterfowl Hunting

Refuge Name: Camas National Wildlife Refuge (NWR)

Location: Camas County, Idaho

Location: Jefferson County, Idaho

Date Established: 1937

Establishing and Acquisition Authorities:
- Executive Order 7720, signed October 8, 1937, dated October 8, 1937
- Migratory Bird Conservation Act of 1929, as amended (16 U.S.C. § 715 et seq.)
- National Wildlife Refuge System Administration Act (16 U.S.C. § 668dd et seq.)

Refuge Purpose(s):

- "… as a refuge and breeding ground for migratory birds and other wildlife." (Executive Order 7720, dated Oct. 8, 1937)
- "… for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. § 715d (Migratory Bird Conservation Act)
- "… conservation, management, and … restoration of the fish, wildlife, and plant resources and their habitats … for the benefit of present and future generations of Americans… " 16 U.S.C. § 668dd(a)(2) (National Wildlife Refuge System Administration Act)

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

Description of Use(s):

The U.S. Fish and Wildlife Service (Service) proposes to continue to allow hunting of waterfowl (ducks, geese, mergansers), American coots, and Wilson's snipe on Camas NWR in accordance with State and Federal regulations. Waterfowl and migratory bird hunting in the United States is guided by an established regulatory process that involves numerous sources of waterfowl population and harvest data. Harvest data are reported by hunters to the State, and season and bag limits are adjusted accordingly to ensure that overall populations of game species remain healthy into the future. Hunting of ducks, geese, mergansers, American coots, and Wilson's snipe is allowed. Migratory game bird seasons run in accordance with State of Idaho regulations. Hunting is permitted seven days per week. Shooting hours correspond to State regulations (½ hour before sunrise until sunset). Hunters are allowed entry to the hunt units one hour before legal hunting hours. Non-toxic shot must be used for all migratory bird hunting, and hunters may not possess lead shot in the field. A valid State license and appropriate Federal and State stamps applicable to the hunted species are required to hunt on the Refuge. No refuge-specific permits or hunter check-in procedures are required.

Hunting of ducks, geese, coots, mergansers, and snipe is allowed on approximately 2,510 acres of the Refuge, which is divided between two separate hunt units: the north unit (980 acres) and the south unit (1,530 acres). Duck and goose hunting is allowed during the State youth waterfowl hunt and all species listed above during State seasons. Seasons are as follows:

Species	State Hunting Season
Waterfowl	October 13-January 25
Dark and Light Geese	October 13-January 25
Wilson’s Snipe	October 13-January 25
American Coot	October 13-January 25

Source: IDFG 2012. 2012 Waterfowl Seasons and Rules. URL: http://fishandgame.idaho.gov/public/docs/rules/waterfowlRules.pdf

Because they reduce the loss of waterfowl to the hunter’s bag and hence can reduce the overall impact to the resource, dogs used in support of hunting are allowed on the Refuge. Temporary blinds of natural vegetation may be constructed, but such blinds are available for general use on a first-come, first served basis. Construction of permanent blinds is prohibited.

Currently the Refuge has limited infrastructure to support its hunting program. Supporting access to the hunting units are 6.5 miles of refuge roads are open to vehicle traffic, and six parking areas (two parking lots in the north hunt unit and four parking lots in the south unit). Both units have signs (Open to Public Hunting) that mark the boundary of the hunt units.

Historically the Refuge provided good waterfowl hunting opportunities. Currently the hunt units rarely hold water during the waterfowl hunting season. Due to the drop in the water table all of the wetlands on Camas NWR are dry by late summer, unless water is pumped from wells. When water is flowing through the main diversion or Independent Ditch, there are some opportunities to jump shoot waterfowl, and a handful of hunters may attempt this per year. Better opportunities exist when waterfowl leave the refuge wetlands in the morning and evening to feed on private agricultural fields. Due to lack of reliable fall water, use of Camas NWR for migratory game bird hunting is very limited, estimated at four to eight hunter visits per season.

In 2018, after the changes in water management described in the CCP are initiated, we would re-evaluate the size and location of the waterfowl hunt area. Depending upon wetland response to changes in water management, we would consider shifting the waterfowl hunt units into areas with more reliable fall water, or enlarging the waterfowl hunt area. Areas open to migratory bird hunting would not exceed 40 percent of the total refuge acres. If the hunt area is expanded we would conduct a new compatibility determination.

Need and Availability of Resources:

The following funds would be required to run the migratory bird and upland game bird hunting programs as designed under the CCP. Costs for both programs are combined here.

Annual Hunt Program Cost for Migratory and Upland Game Birds.

Position	Activity or Product	Reccurring
Refuge Manager	Program Management	$600*
Wildlife Biologist	Resource Monitoring (e.g.sage grouse surveys)	$2,500*
SE ID Complex Park Ranger (LEO)*	Service LE patrols	$3,343*
Regional Office staff,* Eng. Equip. Operator*	Modify existing outreach/regulatory materials; signage upkeep.	$ 500*
Total		$6,943

*Covered under existing funding/salaries

Once the CD is approved through the CCP process, Federal funds would be requested through the Service budget process. Other sources (monetary and non-monetary) would be sought through strengthened partnerships, grants, coordination with other agencies, and additional refuge operations funding to support a safe, quality public use program.

Anticipated Impacts of the Use(s):

Impacts to Habitat:

The primary impact hunters have on habitat is the trampling of vegetation and creation of social trails, which in turn often function as conduits for movement of plant species, including non-native, invasive species (Benninger-Truax et al. 1992; Hansen and Clevenger 2005). The impacts of waterfowl hunters on refuge habitat are expected to be minor. The hunting season on the Refuge starts and ends outside of the growing season of most plants, and numbers of waterfowl hunters are low, so trampling and the spread of invasive plants is not a major issue. Spread of aquatic invasive plants is unlikely since hunting cannot be accessed via boat. Invasive species could however, be spread via contaminated equipment (e.g., decoys or waders).

Impacts to Wildlife (General):

Hunting, by its nature, results in the intentional take of individual animals, as well as wounding and disturbance (DeLong 2002). It can also alter behavior (e.g., foraging time), population structure, and distribution patterns of wildlife (Bartelt 1987; Cole and Knight 1990; Madsen 1985; Owens 1977; Raveling 1979; Thomas 1983; White-Robinson 1982). Waterfowl are wary, seeking refuge from all forms of disturbance, but particularly those associated with loud noise and rapid movement (Dahlgren and Korschgen 1992). Numerous studies show human activities associated with hunting (boating, vehicle disturbance, human presence) cause increased flight time in waterfowl species, which requires a considerable amount of energy (Havera et al. 1992; Kahl 1991; Kenow et al. 2003; Knapton et al. 2000). Human disturbance compels waterfowl to change feeding habits, for example, feeding only at night or deserting feeding areas entirely, resulting in weight loss (Dahlgren and Korschgen 1992).

In addition to loss of individuals of target species, hunting causes disturbance to non-target species because of noise (most notably the report of a firearm), human presence, and general disturbance associated with the activity. Hunting results in the increase of non-target species being injured or killed (accidentally or intentionally) in addition to waterfowl being crippled or killed and not retrieved. These disturbances are manifested by alertness, fright (obvious or unapparent), flight, swimming, disablement or death in non-target species (Dahlgren and Korschgen 1992).

Hunting can contribute to the well-being of wildlife by giving people a deeper appreciation of wildlife and a better understanding of the importance of wildlife and habitat conservation, which ultimately contributes to the NWRS mission. The hunting community remains the largest support base for funding wildlife management programs, and refuges provide an opportunity for a high-quality waterfowl hunting experience to all citizens regardless of economic standing. Many individual refuges have developed extensive public information and education programs bringing hunters into contact with refuge activities and facilitating awareness of wildlife issues beyond hunting. Hunting is one of the six priority public uses of the NWRS.

Impacts of Hunting on Waterfowl

Impacts on waterfowl populations. The hunting of waterfowl in the United States is based upon a thorough regulatory setting process that involves numerous sources of waterfowl population and harvest monitoring data. Waterfowl populations throughout the United States are managed through an administrative process known as flyways, of which there are four (Pacific, Central, Mississippi, and Atlantic). Idaho is included in the Pacific Flyway. A review of the policies, processes, and procedures for waterfowl hunting is covered in a number of documents.

Because the Migratory Bird Treaty Act stipulates that all hunting seasons for migratory game birds be closed unless specifically opened by the Secretary of the Interior, the Service annually promulgates regulations (50 CFR 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, annual Federal regulations both allow and limit the hunting of migratory birds. The Migratory Bird Hunting Frameworks provide season dates, bag limits, and other options for states to select from, which should result in the level of harvest determined to be appropriate based upon Service-prepared annual biological assessments detailing the status of migratory game bird populations. In North America, the process for establishing waterfowl hunting regulations is conducted annually. In the United States, the process involves a number of scheduled meetings (Flyway Study Committees, Flyway Councils, Service Regulations Committee, etc.) in which information regarding the status of waterfowl populations and their habitats is presented to individuals within the agencies responsible for setting hunting regulations. In addition, public hearings are held and the proposed regulations are published in the Federal Register to allow public comment.

For waterfowl, annual assessments used in establishing the Frameworks include the Breeding Population and Habitat Survey, which is conducted throughout portions of the United States and Canada. This survey is used to establish an annual Waterfowl Population Status Report. In addition, the number of waterfowl hunters and resulting harvest are closely monitored through both the Harvest Information Program (HIP) and the Parts Survey (Wing Bee). Since 1995, such information has been used to support the adaptive harvest management (AHM) process for setting duck-hunting regulations. Under AHM, a number of decision-making protocols determine the choice (package) of pre-determined regulations (appropriate levels of harvest) that constitute the framework offered to states that year. Each state's wildlife commission then selects season dates, bag limits, shooting hours, and other options from the their prospective Flyway package. Their selections can be more restrictive, but cannot be more liberal than AHM allows. Thus, the level of hunting opportunity afforded each state increases or decreases each year in accordance with the annual status of waterfowl populations.

Season dates and bag limits for national wildlife refuges open to hunting are never longer or larger than the state regulations. In fact, based upon the findings of an environmental assessment developed when a refuge opens a new hunting activity, season dates and bag limits may be more restrictive than the state allows. Each national wildlife refuge considers the cumulative impacts to hunted migratory species through the Migratory Bird Frameworks published annually in the Service's regulations on Migratory Bird Hunting.

Hunting on refuges as a whole, or Camas NWR specifically, is not likely to have an adverse effect on the status of any recognized waterfowl population in North America. Several points support this contention including (1) the proportion of national waterfowl harvest that occurs on national wildlife refuges is small; 2) there are no waterfowl populations that occur wholly or exclusively on national wildlife refuges; 3) annual hunting regulations within the United States are established to levels consistent with the current population status; 4) refuges cannot permit more liberal seasons than provided for in Federal frameworks; and 5) refuges purchased with funds derived from the Federal Duck Stamps must limit hunting to 40 percent of the available area. While Camas NWR does not fall into this final category, there is sufficient sanctuary area on the Refuge to allow for undisturbed feeding and resting, even in the midst of the hunting season. Refuge-specific regulations are designed to minimize impacts. Both hunt regulations and sanctuary would be continually monitored and evaluated to ascertain their value in balancing the disturbance caused by allowing hunting on the Refuge. Under the stipulations outlined above, this activity does not materially detract from meeting refuge purposes or the Refuge System mission.

<u>Local impacts to waterfowl populations:</u> The Federal Harvest Information Program estimates that 16,800 hunters in Idaho spent an average of 102,700 days hunting and harvested 225,100 ducks annually during 2001-2010. Over that same time period, the harvest information program estimates Idaho hunters harvested 59,800 Canada geese annually. This is the third highest total in the Pacific Flyway, behind Oregon and Washington, respectively. The number of waterfowl currently harvested on the Refuge is unknown, but based on the low numbers of hunters using the Refuge, it is likely to be extremely low, representing a negligible percentage of total numbers harvested in the State and flyway.

<u>Effect on waterfowl distribution and use of habitat:</u> Belanger and Bedard (1995) concluded that disturbance caused by hunting can modify the distribution and use of various habitats by birds. In Denmark, Madsen (1995) experimentally tested disturbance effects of hunting by the establishment of two experimental reserves where hunting activity was manipulated such that sanctuary areas were created in different parts of the study area in different hunting seasons. In both areas, waterbird numbers increased, most strongly in hunted species (a three- to 40-fold increase), with highest densities found in sanctuary areas, regardless of where these sanctuaries were sited. At Sacramento National Wildlife Refuge, in California, researchers found statistically significant differences in the densities of northern pintails among hunting units, units adjacent to hunting units, units adjacent to auto tour route, and units isolated from disturbance (Wolder 1993). Prior to the opening of hunting season, pintail used units in proportion to their availability, indicating no preference to particular areas. During the hunting season, 50 to 60 percent of the pintails on the Refuge were located on the isolated units that contained 26 to 28 percent of the refuge wetlands, suggesting a strong waterfowl preference for areas of little human activity. Units along the auto tour route and adjacent to hunting units maintained pintails at similar proportions to their availability. Three to sixteen percent of the pintails on the Refuge were located on hunted units (36 to 40 percent of the available habitat) during non-hunt days (four days per week) and almost entirely absent on days when hunting was taking place, indicating an avoidance of the hunted areas.

Belanger and Bedard (1989) studied the effect of disturbances to staging greater snow geese in a Quebec bird sanctuary over 471 hours of observation. They found that the level of disturbance (defined as any event causing all or part of the goose flock to take flight) that prevailed on a given day in fall influenced goose use of the sanctuary on the following day. When disturbance exceeded two events per hour, it produced a 50 percent drop in the mean number of geese present in the sanctuary the next day.

Effects on energetics and survival: Hunting limits access of waterfowl to food resources and may modify migration timing. Madsen (1988 as cited by Dahlgren and Korschgen 1992) suggested that hunting on the coastal wetlands of Denmark modified waterfowl movements and caused birds to leave the area prematurely. However, Kahl (1991) suggested that lack of adequate access to food may decrease survival of canvasbacks by causing birds to remain on a staging site longer and forage under suboptimal conditions, or by causing birds to migrate in shorter flights with more frequent stops.

Disturbance due to hunting has caused waterfowl to cease feeding or resting activities, thus decreasing energy intake and increasing energy expenditure. At Chincoteague NWR, Morton et al. (1989) found that wintering black ducks experienced reduced energy intake while doubling energy expenditure by increasing the time spent in locomotion in response to disturbance. Belanger and Bedard (1995) in a quantitative analysis, estimated that neither the response to disturbance by flying away and promptly returning to the foraging site to resume feeding, nor the response of flying away (leaving the foraging site for a roosting site—thus interrupting feeding) allowed snow geese to balance their daytime energy budget.

At high disturbance rates (over two/hour—these included hunting and transport related disturbance), Belanger and Bedard estimated that an increase in night feeding as a behavioral compensation mechanism could not counterbalance energy lost during the day. Likewise, geese could not compensate for a loss in feeding time by increasing their daily foraging behavior to maximize food intake during undisturbed periods. Belanger and Bedard suggested mitigation with spatial or temporal buffer zones.

Considerations for design of hunt units: Fox and Madsen (1997) found that mobile hunting activity close to roosting and or feeding areas is more disturbing than hunting from fixed points or where birds are shot moving between such areas. For sanctuary areas, they recommended areas with regular shape, maximum practicable size, and with a diameter of three times the escape flight distance (at a minimum) of the most sensitive species present. Flock size also affects flush distance, larger flocks tending to react at a greater distance. Based on estimated flight distances from boats, Kahl (1991) recommended that sanctuaries should be at least 1.5-2.0 km square (0.5-0.7 square miles) and encompass as much of a feeding area as feasible.

Application to Camas NWR: The studies cited above display the variety and scale of negative impacts to waterfowl from hunting. The most likely effect would be a shift in waterfowl populations away from hunted areas to non-hunted areas of the Refuge. Under the proposed CCP, approximately 2,510 acres of the Refuge would be open to waterfowl hunting seven days per week. The sanctuary area provided for waterfowl (areas of the Refuge closed to hunting) is more than 8,000 acres, exceeding the size (0.5-0.7 square miles) recommended by Kahl (1991), and it has a low edge-to-area ratio.

The fall waterfowl habitat (permanent open water for loafing, deep and shallow emergent wetland, and croplands) available to migratory birds on the Refuge is limited and currently estimated at approximately 800 acres. Most of this is permanent and semipermanent wetlands in the closed area of the Refuge. Some open water is available early in the hunt season; however, later in the season little open water is available on the Refuge. Under proposed management, only 285 acres of the Refuge would be managed as permanent and semipermanent wetlands—again, all acres would be within the closed area. Within the hunt area, only small areas of water are available in fall. All grain fields (20 acres) are located in the sanctuary area. Under the habitat management proposed in this CCP, fall wetland habitat may increase slightly but the majority of fall wetland habitat would remain within the closed area. Distribution of crops between hunted and non-hunted areas would remain the same. Therefore overall, habitat changes under proposed management would change the acreage and distribution of habitat types, but adequate loafing and feeding areas would exist outside the hunt area. In addition to considerations concerning habitat availability, only non-toxic shot is permitted.

Given the small number of waterfowl hunting visits to the Refuge (currently estimated at approximately four to eight hunter visits per season) disturbance rates would be expected to be low.

<u>Impacts to other wildlife-dependent recreational uses:</u> Public lands attract a variety of user groups who often have conflicting needs. Hunting (especially gunshot noise) has the potential to disturb refuge visitors engaged in other wildlife-dependent recreational uses. There may be safety concerns associated with hunters using the same areas accessed by wildlife observers and photographers. Other uses that may occur at the same time and/or place as waterfowl hunting include vehicle and pedestrian traffic on the 6.5 miles of service roads that lead to or are within the north and south hunt unit for the purposes of wildlife observation and photography. With the limited number of upland and migratory bird hunters using the Refuge at this time, conflicts between bird hunters and non-consumptive users should be minimal.

Conflicts between waterfowl hunters and other refuge users have never been documented and would likely remain negligible for the near future. The current low level of use does not warrant a spatial or temporal separation of hunting from non-hunting public uses at this time. If the number of non-hunters using the hunt area during the hunt season increases significantly, the potential for accidents or user group conflicts may also increase. Conflicts between hunters and non-hunters, and between different types of hunters, would be monitored and addressed if necessary. No significant effects to roads, trails, or other infrastructure from the hunting program are foreseen. Normal road, trail, and facility upkeep and maintenance would continue to be necessary.

By its very nature, waterfowl hunting has very few if any positive effects on waterfowl and other birds while the activity is occurring, but it is well recognized that this activity has given many people a deeper appreciation of wildlife and a better understanding of the importance of conserving their habitat, which has ultimately contributed to the Refuge System mission.

Public Review and Comment:

Public review and comments are being solicited in conjunction with release of this Draft CCP/EA (USFWS 2013) in order to comply with the National Environmental Policy Act and with Service policy. Public review of the step down Hunt Plan (see Stipulations), as required under Service policy, is being conducted concurrently with the release of the Draft CCP/EA before implementing changes to the refuge waterfowl hunting program.

Determination:

____ Use is Not Compatible

_X_ Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

- Each hunter will secure and possess the required State and Federal licenses, tags, stamps or permits.
- Each hunter will comply with the applicable provisions of all State and Federal laws as well as hunting regulations of the State of Idaho.
- Hunters may enter the Refuge 1 hour before shooting time and must leave within 1 hour after shooting time ceases.
- Only those firearms identified for that specific hunting season are allowed.
- It is unlawful to shoot from or across the traveled portion, shoulders, or embankments of any road maintained by any government entity.
- Motorized vehicles will be limited to designated parking areas, with access walk-in from parking lots, except as may be permitted on open roads to remove harvested elk.
- Camping, overnight use, and fires are prohibited.
- No ATVs are allowed on the Refuge.
- No overnight parking is allowed.
- No trapping is allowed.
- It is unlawful to use or possess alcoholic beverages or drugs while on Camas National Wildlife Refuge.
- Individuals may possess, carry and transport, concealed, loaded and operable firearms on the Refuge in accordance with all provisions of state and local law.
- Persons may only use (discharge) firearms in accordance with Refuge regulations (50 CFR 27.42 and specific Refuge regulations in 50 CFR 32).
- Target shooting and sighting-in weapons are not permitted.
- Unless declared as open, all other forms of hunting are prohibited.
- Unless a valid permit (migratory or upland game bird hunting license or big game access permit) allows legal entry on to the Refuge for that season, retrieval of the animal is prohibited.

Migratory Game Bird Regulations Specific to Camas NWR:

- Waterfowl hunting is allowed only in the two designated migratory and upland game bird hunt units.
- Only ducks, geese, coots, mergansers, and snipe may be hunted. Dates, hunting hours and bag limits for these species correspond to State regulations.
- Migratory Game Bird hunters may enter the Refuge 1 hour before shooting time and leave within 1 hour after shooting time ceases.
- Temporary blinds of natural vegetation may be constructed, but such blinds shall be available for general use on a first-come, first-served basis.
- Construction of permanent blinds is prohibited.
- All personal property including decoys must be removed from the Refuge at the end of each day.

- Nontoxic shot is required for all waterfowl and upland game bird hunting and must be 0.20 inches in diameter (T size) or smaller.
- Use of retriever and flushing dogs is allowed. Dogs must be under control of their owners at all times.
- Hunters must pick up spent shotgun shells and all other trash.

Other Stipulations Necessary to Ensure Compatibility:

- Hunt areas and no hunting zones would be posted at least two weeks before the hunting season begins.
- Refuge staff would conduct law enforcement, maintain hunting facilities, and monitor wildlife impacts.

Justification:

Hunting is a priority wildlife-dependent use for the National Wildlife Refuge System through which the public can develop an appreciation for fish and wildlife (Executive Order 12996, March 25, 1996 and the National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57). The Service's policy is to provide expanded opportunities for these wildlife-dependent uses when compatible and consistent with sound fish and wildlife management and ensure that they receive enhanced attention during planning and management. Facilitating hunting on the Refuge would increase visitor knowledge and appreciation of fish and wildlife resources. This enhanced understanding would foster increased public stewardship of natural resources and support for the Service's management actions in achieving the refuge purposes and the mission of the National Wildlife Refuge System.

Waterfowl hunting at Camas NWR as described in this CD contributes to the mission of the National Wildlife Refuge System by providing a wildlife-oriented recreational benefit to Americans. Because sanctuary from human disturbance is provided in other areas of the Refuge, this waterfowl hunting program would not interfere with the Refuge achieving its purposes of providing "a refuge and breeding ground for migratory birds and other wildlife" and the "… conservation, management, and … restoration of the fish, wildlife, and plant resources and their habitats … for the benefit of present and future generations of Americans…." It is anticipated that wildlife populations would find sufficient food resources and resting places such that their abundance and use of the Refuge would not be measurably lessened from allowing hunting to occur on the Refuge. The relatively limited number of individuals expected to be adversely affected due to hunting would not cause wildlife populations to materially decline, the physiological condition and production of wildlife species would not be impaired, their behavior and normal activity patterns would not be altered dramatically, and their overall welfare would not be negatively impacted. Thus, allowing hunting to occur with stipulations would not materially detract or interfere with the purposes for which the Refuge was established or the Refuge System mission.

This program as described was determined to be compatible because: hunter use levels on Camas NWR are relatively low during most days of the waterfowl hunting season (October through November) and sufficient restrictions would ensure that high-quality feeding and resting habitat would be available in relatively undisturbed areas to accommodate the needs of the waterfowl and other wetland birds.

Mandatory Re-Evaluation Date (provide month and year for "allowed" uses only):

2029 Mandatory 15-year Re-evaluation date (for priority public uses)

____ Mandatory 10-year Re-evaluation date (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision:

___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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Signatures for Compatibility Determination 2, Waterfowl Hunting on Camas National Wildlife Refuge:

Prepared by: ______________________________ ____________
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: ______________________________ ____________
(Signature) (Date)

<u>Concurrence</u>

Refuge Supervisor: ______________________________ ____________
(Signature) (Date)

Regional Chief,
National Wildlife
Refuge System: ______________________________ ____________
(Signature) (Date)

B.6 Draft Compatibility Determination for Upland Game Hunting on Camas National Wildlife Refuge

RMIS Database Uses: Upland Game Hunting

Refuge Name: Camas National Wildlife Refuge (NWR)

Location: Jefferson County, Idaho

Date Established: 1937

Establishing and Acquisition Authorities:

- Executive Order 7720, signed October 8, 1937, dated October 8, 1937
- Migratory Bird Conservation Act of 1929, as amended (16 U.S.C. § 715 et seq.)
- National Wildlife Refuge System Administration Act (16 U.S.C. § 668dd et seq.)

Refuge Purpose(s):

- "… as a refuge and breeding ground for migratory birds and other wildlife." (Executive Order 7720, dated Oct. 8, 1937)
- "… for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. § 715d (Migratory Bird Conservation Act)
- "… conservation, management, and … restoration of the fish, wildlife, and plant resources and their habitats … for the benefit of present and future generations of Americans… " 16 U.S.C. § 668dd(a)(2) (National Wildlife Refuge System Administration Act)

National Wildlife Refuge System Mission:

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

Description of Use(s):

The U.S. Fish and Wildlife Service (Service) proposes to continue to allow hunting of upland game birds (ring-necked pheasant, gray partridge, and sage-grouse) on Camas NWR in accordance with State and Federal regulations. Hunting of game as an activity is conducted by the general public under regulatory authority of the National Wildlife Refuge System Improvement Act. Hunting of upland game is allowed throughout the two units open to waterfowl hunting (2,510 acres total). Hunting would be allowed on all days coinciding with the current Idaho Fish and Game pheasant gray partridge, and sage-grouse seasons. Bag limits and lawful methods of take are those documented in the current Idaho Fish and Game Upland Game, Furbearer and Turkey Seasons and Rules brochure (IDFG 2012b). Upland game hunters would be allowed to enter the Refuge one hour before legal hunting hours and remain for one hour after sunset. The 2013-2014 seasons are as follows:

Species	Hunting Season
Gray partridge	September 21-January 31
Sage-grouse	Set by IDFG in August based on lek counts (in 2012 the season in Jefferson County was September 15-September 21.)
Ring-necked Pheasant	October 19-November 30

Source: IDFG 2012. Upland Game, Furbearer, Turkey Seasons and Rules, 2012-13 and 2013-14. URL: http://fishandgame.idaho.gov/public/docs/rules/uplandRules.pdf

Upland game hunting on refuge lands is an extension of the activity already occurring on adjacent public and private lands. No refuge-specific permits or hunter check-in procedures are required. Hunter access would be from the 6.5 miles of road open for hunter access and six existing parking areas located within the hunt units.

To ensure a quality hunt and visitor and staff safety, all hunting activities are in accordance with Federal, State, and refuge-specific regulations. Hunting is a priority public use identified in the National Wildlife Refuge Improvement Act of 1997 and it has traditionally occurred at the Refuge without adverse impacts to the purposes for which the Refuge was established. The hunt program is administered in accordance with sound wildlife management principles and the utmost concern for public safety. Because they can reduce the loss of injured game and hence can reduce the overall impact to the resource, dogs used in the act of hunting upland game birds are allowed on the Refuge. Non-toxic shot must be used for hunting upland birds within the refuge boundary.

Populations of pheasant and gray partridge in the Camas area has been low for several decades, following widespread adoption of center-pivot irrigation, which reduced the field edge habitat used by these species for thermal and security cover. In recent years an estimated six to twelve hunter visits come to the Refuge to hunt pheasant. In general most partridge hunting on the Refuge is opportunistic, not targeted. In recent years the Refuge has not supported many sage-grouse within its boundary during the hunting season. For this reason Camas NWR may only receive one or two visits annually by hunters pursuing sage-grouse.

Need and Availability of Resources:
The following funds would be required to run the migratory bird and upland game bird hunting programs as designed under the CCP. Costs for both programs are combined here.

Annual Hunt Program Cost for Migratory and Upland Game Birds.
(*Covered under existing funding/salaries)

Position	Activity or Product	Reccurring
Refuge Manager	Program Management	$600*
Wildlife Biologist	Resource Monitoring (e.g.sage grouse surveys)	$2,500*
SE ID Complex Park Ranger (LEO)*	Service LE patrols	$3,343*
Regional Office staff,* Eng. Equip. Operator*	Modify existing outreach/regulatory materials; signage upkeep.	$ 500*
Total		$6,943

Anticipated Impacts of Described Use:

Impacts to Hunted Species:

The direct effect of hunting on upland game species is mortality, wounding, and disturbance. Hunting seasons and bag limits for upland game are set by the Idaho Department of Fish and Game with the goal of providing hunting opportunities while managing for sustainable wildlife populations.

Ring-necked pheasant (another introduced species) have undergone a long-term decline as a result of declining habitat quality due to changes in farming practices. In the 1970s and 1980s pheasant numbers were high, but have declined in the last several decades. One of the reasons for this decline is the change in agricultural practices in the area. Prior to the 1990s most agriculture in the Camas area was flood irrigated with ditches, relatively small fields, and consequently, abundant edge habitat (e.g., brush and tall grass) used by pheasants for thermal and security cover. With the shift to center-pivot irrigation, fields are larger with fewer ditches. Consequently, there is very little edge habitat. This has had a devastating effect on the pheasant population and it has not recovered to the high populations of the earlier years. Despite the fact that the population is low compared to historic highs, it is stable, in the cyclic pattern of this species. The Refuge does not actively manage for this species nor would it enhance habitat for the sole benefit of pheasants. Changes in wetland management called for in the CCP may bring a change in vegetation cover that may improve winter survival of pheasants and thus might potentially improve hunting opportunities.

The Idaho Department of Fish and Game's 2010 Upland Game Progress Report (Knetter et al. 2010) notes that of the species of upland game birds that are legal to hunt on Camas NWR, populations of gray partridge (an introduced species) are considered stable or increasing in Idaho's Southeast Region over the past ten to fifteen years. However, populations of gray partridge in the Camas area have met the same fate as pheasants, with local changes in agricultural practices. As with most upland game bird species, gray partridge populations are cyclic and in recent years, populations on the Refuge have been low but stable. As with pheasants, upswings in populations are likely to occur due to changes to habitat management proposed in the CCP, and could provide some quality hunting opportunities in the future.

Greater sage-grouse are a resident native game species. Loss of quality sagebrush habitat in the surrounding area has led to a decline in the number of sage-grouse on the Refuge. Greater sage-grouse populations are cyclic and the Table Butte population, which uses Camas NWR as part of their range, demonstrates this with total male count on lek varying from 77 to 343 over a fifteen year time frame (IDFG 2011). Sage-grouse are listed as a Candidate Species by the USFWS but are still hunted throughout most of their range. Although literature is mixed on whether hunting is compensatory (the proportion of the population that was harvested would die from some other factor if hunting did not occur) or additive (number harvested adds to those that die from other causes), hunting of sage-grouse is permitted in Idaho. IDFG has instituted more restrictive seasons and bag limits in recent years. In 2012, IDFG Area 1 was closed to sage-grouse hunting, while IDFG Area 2 (including Jefferson County) had a one-week season (September 15-21) with a one bird per day limit (two in possession) (IDFG 2012a).

Presently IDFG sets the hunting season every August after examining population data and comparing them to the thresholds set in the statewide conservation plan. The thresholds are as follows: Closed: if less than 100 males observed; or lek counts are less than 50 percent of 1996-2000 average counts; or lek data not gathered for population. Restrictive: if lek counts are between 50 percent and 150 percent of the 1996-2000 average. Standard: if lek counts exceed 150 percent of the 1996-2000 average. The State goal for hunting greater sage grouse is to: “Manage hunting to support the increase of sage-grouse populations in Idaho and for the sustainability of smaller, more isolated populations that may be more vulnerable to overharvest” (Idaho Sage-Grouse Advisory Committee 2006). IDFG also receives input from the nine local sage-grouse working groups that have been established in Idaho. Each local working group considers a variety of factors to make a written suggestion to the IDFG on how each season should be handled.

The most likely effect would be disturbance to upland game birds and movement away from hunted areas to non-hunted areas of the Refuge or off-Refuge. Under the proposed CCP, approximately 2,510 acres of the Refuge would be open to upland game bird hunting seven days per week. The sanctuary area (areas of the Refuge closed to hunting) is more than 8,000 acres, and it has a low edge-to-area ratio. Approximately 40 acres of hayfields (15 percent) are located within the north hunt area. A total of 80 acres of Refuge croplands (50 percent) are located in the south hunt area; however these are alfalfa fields; all grain fields are located in the sanctuary area. Under the habitat management proposed in this CCP, distribution of crops and hayfields between hunted and non-hunted areas would remain the same and adequate cover and feeding habitat would exist outside the hunt area. In addition to considerations concerning habitat availability, only non-toxic shot is permitted.

The impacts to populations of upland game, both locally and regionally, caused by hunting of upland game on Camas NWR are likely inconsequential due to the paucity of these species on the Refuge, and the low numbers of hunters pursuing those species. The most frequently hunted upland game species on the Refuge are gray partridge and ring-necked pheasant. Populations of grouse, partridge, and pheasant are low in the refuge area, and few grouse, partridge, or pheasant are harvested on the Refuge each year. The low numbers of grouse, partridge, and pheasant, and the subsequent lack of hunter pursuit, means there is little impact to these species related to hunting on the Refuge.

Impacts to Other Wildlife Species:

Upland game bird hunters are allowed to use flushing and retrieving dogs. Upland game hunting dogs are typically used to detect and retrieve birds. Any dog, particularly when free roaming and not under some type of control, may have a serious impact on non-target wildlife, especially in the spring (Sime 1999). However, partridge and pheasant hunting are only allowed in the fall, and bird hunting by its nature requires close control of the dog by the hunter. Because of the limited number of hunters pursuing upland game birds, the very small percentage of those using dogs and the season of use, any impact to other wildlife would be very small.

Upland game hunting occurs in the fall and winter, after the nesting season for birds and the rearing season for all forms of wildlife. While the presence of hunters can temporarily influence resident game and non-game wildlife by increasing their level of stress and possibly causing them to flee in alarm, it is expected that impacts to non-target species would be minimal because hunting seasons do not coincide with nesting seasons, so reproduction would not be reduced by hunting. Disturbance to the daily activities, such as feeding and resting, of wintering non-hunted birds and other wildlife might occur. However, these occurrences are infrequent and short lived, and limited to 24 percent of the Refuge (2,510 acres on the west side of the Refuge). The impacts caused by upland game hunting to other species inhabiting the Refuge are likely inconsequential due to the limited area where this use occurs and the low number of hunters engaged in this use.

Refuge regulations further mitigate possible disturbance by hunters to non-hunted wildlife. Vehicles are restricted to roads and the harassment or taking of any non-target wildlife is not permitted. Although ingestion of lead shot by non-hunted wildlife could be a cumulative impact, it is not relevant at the Refuge because non-toxic shot is required.

Impacts to Other Wildlife-dependent Recreational Uses:

Public lands attract a variety of user groups who often have conflicting needs. Hunting (especially gunshot noise) has the potential to disturb refuge visitors engaged in other wildlife-dependent recreational uses. There may be safety concerns associated with hunters using the same areas accessed by wildlife observers and photographers. Other uses that may occur at the same time and/or place as upland game bird hunting include vehicle and pedestrian traffic on the 6.5 miles of service roads that lead to or are within the north and south hunt units for the purposes of wildlife observation and photography. With the limited number of upland game bird hunters using the Refuge at this time, conflicts between hunters and non-consumptive users should be minimal.

Conflicts between upland game bird hunters and other refuge users have never been documented and would likely remain negligible for the near future. The current low level of use does not warrant a spatial or temporal separation of hunting from non-hunting public uses at this time. If the number of non-hunters using the hunt area during the hunt season increases significantly, the potential for accidents or user group conflicts may also increase. Conflicts between hunters and non-hunters, and between different types of hunters, would be monitored and addressed if necessary. No significant effects to roads, trails, or other infrastructure from the hunting program are foreseen. Normal road, trail, and facility upkeep and maintenance would continue to be necessary.

Summary and Application to Camas NWR:

While upland game hunting has no positive effects on these species as the activity is occurring, it is well recognized that this activity has given many people a deeper appreciation of wildlife and a better understanding of the importance of conserving their habitat, which has ultimately contributed to the Refuge System mission. To date, this activity has shown no assessable environmental impact to the Refuge, its habitats or wildlife species.

Public Review and Comment:

Public review and comments are being solicited in conjunction with release of this Draft CCP/EA (USFWS 2013) in order to comply with the National Environmental Policy Act and with Service policy. Public review of a step-down Hunt Plan (see Stipulations), as required under Service policy, is being conducted concurrently with public review of the Draft CCP/EA, before implementing changes to the refuge upland game hunting program.

Determination:

____Use is Not Compatible

_X__Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

- Each hunter will secure and possess the required State and Federal licenses, tags, stamps or permits.
- Each hunter will comply with the applicable provisions of all State and Federal laws as well as hunting regulations of the State of Idaho.
- Hunters may enter the Refuge 1 hour before shooting time and must leave within 1 hour after shooting time ceases.
- Only those firearms identified for that specific hunting season are allowed.
- It is unlawful to shoot from or across the traveled portion, shoulders, or embankments of any road maintained by any government entity.
- Motorized vehicles will be limited to designated parking areas, with access walk-in from parking lots, except as may be permitted on open roads to remove harvested elk.
- Camping, overnight use, and fires are prohibited.
- No ATVs are allowed on the Refuge.
- No overnight parking is allowed.
- No trapping is allowed.
- It is unlawful to use or possess alcoholic beverages or drugs while on Camas National Wildlife Refuge.
- Individuals may possess, carry and transport, concealed, loaded and operable firearms on the Refuge in accordance with all provisions of state and local law.
- Persons may only use (discharge) firearms in accordance with Refuge regulations (50 CFR 27.42 and specific Refuge regulations in 50 CFR 32).
- Target shooting and sighting-in weapons are not permitted.
- Unless declared as open, all other forms of hunting are prohibited.
- Unless a valid permit (migratory or upland game bird hunting license or big game access permit) allows legal entry on to the Refuge for that season, retrieval of the animal is prohibited.

Upland Game Bird Regulations Specific to Camas NWR:

- Upland game bird hunting is allowed only on the two designated waterfowl and upland game hunt units.
- Only ring-necked pheasant, gray partridge, and sage-grouse may be hunted. Dates, hunting hours and bag limits for these species correspond to State regulations.
- Upland Game Bird hunters may enter Refuge 1 hour before shooting time and leave within 1 hour after shooting time.
- Firearms used in upland game bird hunting are restricted to the use of shotguns only.
- Use of retriever and flushing dogs is allowed. Dogs must be under control of their owners at all times.
- Hunters must pick up spent shotgun shells and all other trash.
- Nontoxic shot is required for all waterfowl and upland game bird hunting and must be 0.20 inches in diameter (T size) or smaller.

Other Stipulations Necessary to Ensure Compatibility:

- Refuge staff would conduct law enforcement, maintain hunting facilities, and monitor wildlife impacts.

Justification:

This use has been determined compatible provided the above stipulations are implemented. Upland game hunting would contribute to the mission of the National Wildlife Refuge System by providing a wildlife-oriented recreational benefit to Americans. Hunting is also one of the six wildlife-dependent recreational uses of the National Wildlife Refuge System as stated in the National Wildlife Refuge System Improvement Act of 1997. The hunting program follows all applicable laws, regulations, and policies including: 50 CFR, National Wildlife Refuge System Manual, National Wildlife Refuge System goals and objectives, and Camas NWR goals and objectives. Conducting this program does not alter the Refuge's ability to meet habitat goals, provide for public safety, and support several primary objectives of the Refuge.

Upland game hunting seasons and bag limits are established by the State of Idaho, ensuring the continued well-being of overall populations. Hunting does result in the taking of individuals within the overall population, but restrictions are designed to safeguard an adequate breeding population from year to year. It is anticipated that wildlife populations would find sufficient food resources and resting places such that their abundance and use of the Refuge would not be measurably lessened from allowing upland game hunting to occur on the Refuge. The relatively limited number of individuals expected to be adversely affected by hunting would not cause wildlife populations to materially decline, the physiological condition and production of wildlife species would not be impaired, their behavior and normal activity patterns would not be altered dramatically, and their overall welfare would not be negatively impacted. Thus, allowing upland game hunting to occur with stipulations would not materially detract or interfere with the purposes for which the Refuge was established or the Refuge System mission.

Mandatory Re-Evaluation Date (provide month and year for "allowed" uses only):

2029 Mandatory 15-year Re-evaluation date (for priority public uses)

____ Mandatory 10-year Re-evaluation date (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision:

___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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Signatures for Compatibility Determination 3, Upland Game Hunting on Camas National Wildlife Refuge:

Prepared by:	______________________________ (Signature)	__________ (Date)
Refuge Manager/ Project Leader Approval:	______________________________ (Signature)	__________ (Date)

Concurrence

Refuge Supervisor:	______________________________ (Signature)	__________ (Date)
Regional Chief, National Wildlife Refuge System:	______________________________ (Signature)	__________ (Date)

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B.7 Draft Compatibility Determination for Big Game (Elk) Hunting at Camas NWR

RMIS Database Uses: Big Game Hunting (Elk)

Refuge Name: Camas NWR

Location: Jefferson County, Idaho

Date Established: 1937

Establishing and Acquisition Authorities:

- Executive Order 7720, signed October 8, 1937, dated October 8, 1937
- Migratory Bird Conservation Act of 1929, as amended (16 U.S.C. § 715 et seq.)
- National Wildlife Refuge System Administration Act (16 U.S.C. § 668dd et seq.)

Refuge Purpose(s):

- "… as a refuge and breeding ground for migratory birds and other wildlife." (Executive Order 7720, dated Oct. 8, 1937)
- "… for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. § 715d (Migratory Bird Conservation Act)
- "… conservation, management, and … restoration of the fish, wildlife, and plant resources and their habitats… for the benefit of present and future generations of Americans… " 16 U.S.C. § 668dd(a)(2) (National Wildlife Refuge System Administration Act)

National Wildlife Refuge System Mission:

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

Description of Use(s):

Current Use:

Currently, big game hunting is not allowed on Camas NWR.

Proposed Use:

Beginning in the fall of 2014, the Refuge proposes to implement a controlled hunt season on a portion of the Refuge consistent with Idaho Department of Fish and Game (IDFG) seasons, bag limits, and special conditions of Game Management Unit (GMU) 63, which surrounds the Refuge. The hunt would occur on 4,112 acres of Service-owned lands, generally described as the southern and western portion of the Refuge, south of the core wetlands and auto tour route, and west of Camas Creek. This area includes sagebrush-steppe, willow riparian, and wetland habitat. This area includes and overlaps with one of the current waterfowl and upland game bird hunting areas. The elk hunt area would be closed to public uses other than hunting during the hunting season. Map 7 of the Draft CCP (page 2-25) illustrates the area proposed to be opened to elk hunting.

The hunt would create a safe and quality recreational opportunity, providing a reasonable opportunity to harvest elk. Additionally, the hunt would be predominantly for antlerless elk, the goal of which is to reduce local depredation complaints. An antlerless elk hunt would be conducted from Sept 1-December 31. The controlled any-elk hunt (August only) would provide hunters with a quality hunt opportunity for bulls, while the antlerless hunt is designed to reduce localized depredations. The season dates for hunting elk on Camas NWR, would coincide with the rules for the Game Management Unit (GMU) 63 hunt as specified in the IDFG publication Big Game Hunting Rules. Elk hunting seasons for GMU 63 are listed in the table below.

Proposed Controlled Hunt Season for Camas NWR

Type of Hunt	Period	Refuge Access Permits Issued	Duration
Any Elk	Aug 1-August 31	Up to 4 *	31 days
Antlerless Elk	Sept 1-Dec 31	Up to 16*	122 days

Source: Elk General Zone Seasons. URL: http://fishandgame.idaho.gov/public/docs/rules/bgElk.pdf

The Refuge would issue up to 20 access permits for elk hunting annually. The number of access permits issued may vary from year to year and would be determined by the staff of Camas NWR in coordination with the IDFG before the beginning of each season. By using an access permit process for the elk hunt, the Refuge can ensure safety and prevent conflicts with other refuge activities. A limited number of access permits allows for low hunter density, providing a safe, uncrowded, quality hunt.

To be eligible to apply for refuge elk hunting access permits, hunters must hold valid State elk tags for GMU 63. Mobility impaired hunters must hold a valid State disabled combination hunting license, and must also meet at least one the following refuge-specific criteria: 1) Must have a mobility impairment resulting from permanent medical conditions which makes it physically impossible for them to hunt without the assistance of an attendant; 2) Need a medically prescribed assistive device for mobility; or 3) Must be at least 65 percent disabled.

Applications for permits would be available at the refuge office and on the refuge website. Applications for a refuge elk hunting access permit must be submitted by the second Friday in July of each year. Selection for refuge access permits would be made by the U.S. Fish and Wildlife Service by random draw. The draw for permits would occur on the following Monday. Priority for the access permits would be given to youth hunters (age 12-17 at the time of application), and disabled hunters who have a mobility impairment. However, hunters that do not meet the criteria of youth or mobility impaired are encouraged to apply for access permits. If the number of youth and mobility impaired hunter applicants is less than the total number of access permits being issued in a given season, other applications would be included in the drawing for access permits. After the first season, preference would be given to those whom have not previously been issued access permits. Youth hunters must be accompanied by an adult. Mobility impaired hunters may be accompanied by a non-hunting companion designated in writing in accordance with State regulations. They may be assisted by refuge staff or a trained refuge volunteer upon request.

The access permit would allow hunting on certain days of the week as follows: Friday, Saturday, Sunday, Monday and Tuesday. Hunters would be assigned a two-week hunt period that would be determined by random draw. Therefore, ten (10) two-week hunt periods would be established throughout the season, with a maximum of two hunters allowed on the Refuge per period. Applicants for access permits may request specific hunt periods. Priority hunting dates would be given to youth hunters and mobility impaired hunters. Within the season noted above, hunting dates must be coordinated by the permit holder with the refuge manager at least seven days prior to arrival. Hunters may hunt as many days as necessary to harvest an animal within the two-week timeframe allowed under the access permit; therefore a permit would allow hunters to access the Refuge for up to ten days. Specific regulations are described below in Stipulations Necessary to Ensure Compatibility, below, and hunting dates are listed in the previous table.

The season dates for hunting elk on Camas NWR, would coincide with the rules for the Unit 63 hunt as specified in the Idaho Fish and Game publication *Big Game Hunting Rules*. Therefore, hunters who draw an access permit for August would have a chance to harvest a bull elk as per State regulations. After the drawing for access permits has occurred, hunters must attend a pre-hunt orientation with refuge staff or trained volunteers, where they would be briefed on the hunt area boundary, safety, and other special regulations or issues that may affect the hunt (for example, avoiding disturbance to staging migratory bird flocks). Hunters would be advised to maintain at least a 400 meter (¼ mile) distance from sandhill crane roosts and sandhill cranes or trumpeter swans with broods.

Weapons used must be shoulder fired, center fire with cartridges larger than 20 caliber. No permanent structures may be constructed on Service lands. Mobility impaired hunters may use temporary hunting blinds. They would be taken to and from hunting blinds by refuge personnel or a trained refuge volunteer using a refuge-owned utility terrain vehicle (UTV). Hunting from vehicles is prohibited.

Hunters would be asked to make every effort to retrieve wounded game. Successful hunters (or designated assistants of mobility impaired hunters) would be allowed to move a harvested elk to the nearest established, designated refuge road by foot. Vehicles can then be used to remove the elk from the Refuge. If a mobility impaired hunter does not an assistant, Refuge personnel or a trained volunteer would aid in the removal of elk and would determine the best route for removal of game. If a wounded animal leaves the area open to elk hunting on the Refuge and enters an area that is closed to hunting, the hunter or assistant would be escorted by refuge staff or trained volunteer to retrieve the game. If a wounded animal leaves the refuge and enters private land, permission must by granted by private landowners to attempt retrieval, in accordance with Idaho laws.

Refuge personnel would meet in January to evaluate the safety and quality aspects of this hunt and make adjustments to number of hunters and area closures if necessary to ensure a safe, quality hunt that minimizes impacts to sensitive non-target wildlife resources. The refuge manager would meet with the regional IDFG staff annually in May to discuss elk population levels in the general area and decide on the number of access permits that would be allowed for the Refuge based upon the effectiveness of the previous season's elk hunt. The Refuge would implement, as needed, spatial or temporal closures to protect sensitive non-target wildlife resources such as sandhill crane roosts, or crane and trumpeter swan pairs with broods. Of specific concern is Rays Lake, which is used as a pre-migration staging area by greater sandhill cranes. There is a low possibility of sandhill crane pairs with colts, and trumpeter swans with broods, being present in the hunt area early in the hunt season. Upon detection, sensitive resources would be mapped and closure areas established to buffer the resource. A buffer area of 400 meters (¼ mile) around sandhill crane roosts and wetlands with swan broods is considered necessary and appropriate should these resources be present during the hunting season.

Why this use is being proposed: Hunting is one of the six priority public uses on national wildlife refuges, as defined by the 1997 amendments to the National Wildlife Refuge Administration Act of 1966. If compatible, these six priority uses are to receive enhanced consideration over other general public uses in refuge planning and management. Hunting can also be a valuable management tool to help regulate wildlife populations. Hunting has given many people a deeper appreciation of wildlife and a better understanding of the importance of wildlife and habitat conservation, which ultimately contributes to the National Wildlife Refuge System mission.

The objectives of the proposed elk hunt on Camas NWR are: 1) To offer quality recreational hunting opportunities; 2) to maintain and improve riparian habitat condition on the Refuge; and 3) to assist the IDFG in reducing the elk population locally, in order to alleviate depredation on surrounding private lands. The proposed hunt is intended to offer a quality and unique elk hunting opportunity to mobility impaired and youth hunters. The hunt would offer a reasonable opportunity to harvest elk. Hunting may improve riparian habitat condition on the Refuge, both by direct reduction of herd size and by dispersing elk from riparian habitat. The controlled elk hunt would help alleviate localized depredation issues on nearby agricultural lands by reducing the elk population, and/or dispersing elk onto adjacent private or public (BLM) lands where they may be hunted.

Need and Availability of Resources:

The proposed elk hunt would not require any additional infrastructure. Hunter access to the Refuge would be accommodated by existing parking areas and roads. Administration of the hunt plan would add some workload to existing staff with many of the demands (education, outreach, recruiting and training volunteers) occurring in the first years of the elk hunt. Signs would require updating and existing brochures would need to be modified. Annual expenses include receiving applications for and issuing permits; conducting hunter orientation; monitoring the impacts of the hunt program; addressing public inquiries; interagency coordination; and additional law enforcement patrols. The number of elk hunt access permits issued during the first few years of program implementation would be low (an estimated eight to ten permits would be issued for each season) to allow the Refuge to evaluate the staff time needed to administer the hunts, as well as safety, law enforcement, and resource issues. Existing staff (management, biological, law enforcement, maintenance) and funding available to administer the proposed elk hunt are limited but sufficient. The approximate expenses for implementation and management of the elk hunt program shown in the table below.

Estimated Initial and Annual Cost for Elk Hunt Program

Position	Activity or Product	Initial	Reccurring
Refuge Manager*	Coordination with IDFG and program management; hunt plan updates		$1800*
Wildlife Biologist*	Resource monitoring (e.g. , elk surveys, willow habitat) (Refuge Biologist)		$3500*
SE ID Complex Park Ranger (LEO)*	Service LE patrols (3 per week for 5 months)		$13,372*
Refuge Manager,* Park Ranger	Provide hunter orientation; assist mobility impaired hunters, assist with game retrieval outside hunt area (Refuge staff)		$3500
Regional Office staff*	Develop updated information/outreach materials (print and Web)	$1000*	
Regional Office staff,* Eng. Equip. Operator*	Sign access points to elk hunt area	$1800*	
SE ID Complex Visitor Services Manager; Park Ranger	Recruit/train volunteers to assist mobility impaired hunters	$ 3000	$1,600
Total		$5,800	$23,772

*Covered under existing funding/salaries

Federal funds would be requested through the Service budget process to administer the hunt. Other sources (monetary and non-monetary) would be sought through strengthened partnerships, grants, coordination with other agencies, and additional refuge operations funding to support a safe, quality public use program.

Anticipated Impacts of Described Use:

Impacts to Habitats:

Foot travel associated with elk hunting could potentially result in trampling of vegetation and minor impacts to subcanopy riparian cover. Since elk hunting would involve small numbers of spatially dispersed hunters, and primarily takes place during the time of year when most understory and wetland plants are dormant, this activity would likely have little direct impact on vegetation. Providing opportunities for mobility impaired hunters may require the use of temporary blinds and utility terrain vehicles (UTVs) to transport them to hunting sites. Impacts to vegetation would be limited because of the small number of mobility impaired participants each hunting season. Mobility impaired hunters would be taken to and from hunting blinds by refuge personnel or a designated volunteer, who would use refuge-owned UTVs and travel routes that minimize off-road travel and cause the least amount of damage to vegetation.

The inadvertent introduction of non-native plants into new areas via hunters' boots, clothing, and equipment may also occur (Benninger-Traux et al. 1992). Once established, invasive plants can out-compete native plants, thereby altering habitats and indirectly impacting wildlife. Educational materials and orientation provided to hunters would advise them of the potential to introduce invasive species and steps the can take to minimize risk of introduction. Invasive plants would be monitored and controlled as part of the Refuge's Integrated Pest Management Plan.

Minor impacts to soil and water are anticipated due to the low total number of hunters and the dispersed nature of the activity. Additionally, the proposed hunt uses existing infrastructure for parking, vehicle, and pedestrian access.

Although impacts to habitats within the hunt areas due to hunter activity are expected to be minor, redistribution of elk due to hunting could cause impacts to habitat. Within the hunt area, impacts are likely to be beneficial through reduced browsing pressure on willows, allowing for willow regeneration on the south end of the Refuge around Rays Lake where the elk herd spends the bulk of its time. A browse survey was conducted in the fall of 2012 to see what effect elk were having on willow habitat on the Refuge (Keigley 2012). The results of the survey indicate that the willows in and around Rays Lake are being browsed to a point where minimal regeneration is occurring. This in turn, is a concern because willows provide important habitat for landbirds on the Refuge during migration. Conversely, habitat condition could be reduced in non-hunting areas of the Refuge through trampling and direct herbivory. Higher densities over prolonged periods can have impacts to habitat structure, as young plants are consumed, suppressing the number of potential recruits into older age classes. Vegetation monitoring would be conducted to determine if this elk hunt causes changes to elk use of the Refuge and therefore, changes in riparian habitat condition.

Impacts to Elk:

Hunting by its nature, results in the direct take of individuals animals, as well as wounding and disturbance (DeLong 2002). It can also alter behavior (e.g., foraging time), population structure, and distribution patterns of wildlife (Bartelt 1987; Cole and Knight 1990; Madsen 1985; Owens 1977; Raveling 1979; Thomas 1983; White-Robinson 1982). The Refuge has coordinated closely with the State in developing an elk hunt that falls within frameworks for the general elk hunt within GMU 63. The Preferred Alternative would provide a quality hunting experience while supporting IDFG's in objectives for the Snake River Management Zone (which includes GMUs 53, 63, 63A, 68A), specifically as it applies to alleviating depredation to agricultural croplands. IDFG's proposed 10-year management direction for the Snake River Zone is as follows: "Management direction in the Snake River Zone involves decreasing the current elk population. The zone is dominated by agricultural lands and small communities that are not compatible with large numbers of resident elk. It is proposed to continue managing for minimal elk numbers by using long, liberal hunting seasons and prompt responses to crop and property damage on agricultural lands." (IDFG 2013, Draft Idaho Elk Management Plan 2014-2024).

Historically GMU 63 had depredation hunts but since these hunts were occurring every year, IDFG decided to initiate an annual controlled hunt (Meints 2012). For the past fifteen years or so this unit has had one of Idaho's longest, most liberal (5 months long) elk hunting seasons. The liberal hunting season in GMU 63 makes this hunt essentially function as a depredation hunt.

IDFG estimated a population of 380 elk in the Snake River Zone in 2011 (IDFG 2011). Total harvest on GMU 63 has ranged from 70 to 257 annually, and the harvest increased annually until 2010 (Meints 2012). The harvest dropped markedly in 2011; however, one factor influencing the 2011 harvest may have been mild weather conditions; therefore harvest data do not necessarily indicate lower population levels. Harvest data for GMU 63 are tabulated below in the table below.

GMU 63 Elk Harvest Data

Year	Hunters	Total Harvest	Bulls	Cows
2011	684	70	27	43
2010	755	257	58	199
2009	603	138	39	99
2008	598	155	37	118
2007	496	112	47	65
2006	327	107	22	85

Source: IDFG 2012b.

Disease issues (e.g., brucellosis) are also a concern with the elk in Unit 63. Brucellosis has been found in the Island Park herd and IDFG is working with cattle ranchers to address this threat. At this time IDFG have no documentation of brucellosis on the west side of Interstate 15. However IDFG continues to opportunistically test elk from GMU 63, often requesting samples from hunters. Chronic wasting disease has not been documented in Idaho but approximately 400 animals are tested every year in Southeastern Idaho (Meints 2012).

The first elk sighting documented on the Refuge was that of two elk in 1937, seen near Rays Lake in September. Throughout the years elk were sporadically documented on the Refuge ranging from one to four animals every five to ten years. The first year that elk were documented in a group larger than four animals was 1994, when 27 animals were reported. Elk population surveys were first initiated in 2008 with visual surveys attempted several times a month (see table below).

Camas NWR Elk Survey 2008-2009. Number of counts conducted per month in parentheses.

Date	Sept 08 (1)	Oct 08 (5)	Nov 08 (1)	Dec 08 (1)	Jan 09 (3)	Feb 09 (3)	Mar 09 (1)	Apr 09 (3)	May 09 (2)
High Count	64	99	105	130	117	105	78	46	50
Low Count	64	92	105	130	38	90	78	0	6

Using the above survey data and other recent general observations, it is estimated that the Refuge supports from zero to 150 elk seasonally. The numbers are typically highest in the fall and winter and lower in the spring and summer. The bulk of the elk spend their time south of the auto tour route, primarily around Rays Lake. It is felt that some of these elk are a resident herd while other elk use the area solely as a wintering ground. It has been speculated that elk migrate into GMU 63 from two directions: animals coming south across Highway 22 out of the Beaverhead Mountain Range, and animals coming from the Island Park/Yellowstone area and crossing Interstate 15.

In the proposed hunt up to 20 refuge permits would be made available to harvest elk annually, and we assume that not all hunts would be successful. Therefore the Camas hunt would represent only a small fraction of the total harvest in the GMU and would not result in significant cumulative impacts to elk populations regionally or statewide. Nevertheless, an increase in harvest in GMU 63 would help reduce the local population to levels that are socially acceptable, by reducing direct financial losses to farmers. As reproductive cows are removed from the local population by the antlerless hunt, it is assumed that the controlled elk hunt may assist IDFG in achieving IDFG's desired population reduction in the Snake River Zone.

Hunting is the traditional means used by IDFG to manage elk populations. The influence of hunting on population dynamics of Idaho elk populations is understood and well documented (Hayes et al. 2002; Hughbanks 1993; Unsworth et al. 1993). By working with IDFG to develop a refuge elk hunting program, the proposed elk hunt may mimic the ecological role that large predators once served, in both removing a segment of the population and also causing disturbance and animal movement. The Refuge acknowledges that hunting is not a direct ecological substitute for predators (Darimont et al. 2008), as predators would naturally remove the sick, weak, or injured animals, whereas hunters often target the healthiest, largest animals for removal (Coltman et al. 2003; Edeline 2007; Milner and Andreassen 2006). Yet, in the absence of many large predators, elk hunting on Camas NWR may provide some population level regulation for IDFG, as well as a source of disturbance that modifies animal use patterns. Providing some hunting pressure on the Refuge may deter the elk from using the Refuge as a safe haven and disperse them off the Refuge onto other public or private lands that surround the Refuge where hunting may occur.

As well as causing direct mortality, hunting may be an indirect cause of mortality or reduced herd productivity. Depending on the range of variables associated with hunting activity, the Refuge can anticipate a variety of elk behavioral responses to hunter activity associated with the refuge elk hunt. Examples of disturbance variables that affect elk behavior include type, distance, direction of movement, speed, predictability, frequency, magnitude, and location of the activity (Knight and Cole 1995). Wildlife disturbance can precipitate behavioral changes, such as avoidance, habituation, or attraction (Knight and Temple 1995). Disturbance of wildlife species that habituate to human use tends to be greater when recreational activities occur away from established use areas such as parking areas and trails (Cole 2004). Wildlife physiological responses can include the "fight or flight" response, with elevated heart and respiratory rates, or the "freeze" response, with inhibition of activity and reduced heart and respiratory rates (Millspaugh 1999). Most big game ungulates either run (flight) or hide (freeze) in response to hunting pressure. If animals successfully elude hunters by running, the energetic cost may deplete fat reserves needed for survival during winter in temperate regions. If animals successfully elude hunters by hiding, there may be an energetic cost from lost foraging opportunities. Most studies of ungulate responses to hunting have focused on changes in habitat selection. Ungulates typically respond to hunting by seeking areas of security (Edge and Marcum 1985; Irwin and Peek 1979; Knight 1980; Millspaugh et al. 2000; Naugle et al. 1997), by altering activity patterns (Naugle et al. 1997), by adjusting home ranges (Kufield et al. 1988; Root et al. 1988) or by moving long distances (Conner et al. 2001; Vieira et al. 2003). Generally, elk respond to disturbance by fleeing; whereas, deer elude hunters by hiding (Johnson et al. 2005). However, the difficulty of monitoring hunter density and elk and deer populations on large landscapes has prevented the collection of sufficient data to develop models of energetic costs associated with hunting or with other recreational activities. Variation in weather, hunter density, herd dynamics and seasonal conditions can likely bring about changes in the interactions between refuge hunters and animals, making generalizations tenuous at best.

Quantitative relationships between levels of hunting pressure and energy expenditure can be used to evaluate potential secondary effects of activities on nutritional condition of ungulates. For instance, frequent hunter disturbance from the proposed refuge elk hunt could result in high energy expenditure by ungulates adversely affecting animal weight dynamics in winter, when forage is scarce, or in summer, when energy requirements are high for lactation and rebuilding body mass following winter (Cook et al. 2004). During hunting seasons, energetic consequences of the increased disturbance include increased energetic costs associated with movements (Johnson et al. 2005) and perhaps shifts to habitats where foraging conditions are diminished. The implications of disturbance are often heightened during sensitive life stages, such as elk migration and overwintering (Unsworth et al. 1993). Depending on the disturbance variables listed above, the long-term effects on individual animals can be altered behavior, reduced vigor, lower reproductive success, and/or death (Knight and Cole 1995). Disturbance during parturition and calf rearing resulted in higher calf mortality (Phillips and Alldredge 2000) or decreased reproductive performance of mule deer in the following year (Yarmoloy et al. 1988).

Elk within GMU 63 would likely indirectly incur higher energy costs due to hunter disturbance from the proposed elk hunt on Camas NWR, as the Refuge would cease to serve as safe sanctuary from disturbance and hunting pressure. This could indirectly lead to reduced body condition and reproductive fitness as elk may have to deplete stored fat reserves to avoid hunters and forage on more remote and less secure BLM rangelands. It is unlikely, however that hunting would exacerbate winter mortality, since this is not a limiting factor of the GMU 63 elk herd (Schmidt 2013).

In summary, the refuge hunt would result in a minor increase in direct mortality of the elk herd in GMU 63, and could cause a slight decrease reproductive fitness of individual animals. Therefore the hunting program could contribute to a decline in long-term herd productivity in GMU 63. However this would be in line with the IDFG’s elk management objective for the Snake River Zone, including GMU 63, which is to reduce the current population through a long, liberal hunting seasons and response to crop and property damage.

Impacts to Other Wildlife Species:

Elk hunting on the Refuge could also disturb some non-target wildlife species. Disturbance to the daily activities, such as feeding and resting, of migrating or wintering non-hunted birds and other wildlife might occur. Hunting causes disturbance to non-target species because of noise (most notably the report of a firearm), human presence, and general disturbance associated with the activity. These disturbances are manifested by alertness, fright (obvious or unapparent), flight, swimming, disablement or death in non-target species (Dahlgren and Korschgen 1992). This effect is likely a minor negative effect due to the low numbers of hunters using the Refuge (both at any given time, and total over the season). Refuge regulations further mitigate possible disturbance by hunters to non-hunted wildlife. Vehicles (except refuge-owned utility terrain vehicles used to transport and retrieve game harvested by mobility impaired hunters) are restricted to roads. Refuge personnel or a designated volunteer would take mobility impaired hunters to and from hunting blinds and assist in retrieval of game, which may require off-road travel; however they would use travel routes that minimize off road travel and disturbance to non-hunted wildlife.

The majority of elk hunting would occur in the fall, after the nesting and rearing season for most birds and other wildlife has been completed; therefore, reproduction of most species would not be directly impacted by hunting. However, trumpeter swans are a potential exception due to their long brood-rearing period (see below). The main concerns would be for wildlife that use the Refuge for foraging in preparation for, or during, fall migration (e.g., sandhill cranes); wildlife that use that Refuge for roosting (e.g., Canada geese); and wildlife that use the Refuge for winter foraging and thermal cover (e.g., white-tailed deer).

For example, white-tailed deer use some of the same habitats that are used by elk. Numbers of white-tailed deer are usually low during the beginning of the elk season. Most the white-tailed deer that use Camas NWR do so during the rut (late October and November) and throughout the winter months. Also, white-tailed deer spend the majority of their time in the central part of the Refuge, outside of the elk hunting area. The elk spend the bulk of the time in the southern half of the Refuge and appear to mix only when feeding after dark, after shooting hours. While disturbance to white-tailed deer may occur, these occurrences would short lived and relatively rare given the low numbers of hunters that would be present on the Refuge at any given time and the low total number of permits that would be issued during the hunt season (20 maximum).

The amount and degree of disturbance to waterfowl would depend on the condition of the refuge wetlands, in particular Rays Lake and Sandhole Lake. If late season water is present, waterfowl, mostly Canada geese, will use these areas for roosting during the elk season. As fall approaches Canada geese tend to congregate in larger flocks and look for larger bodies of water to roost upon. Both Rays Lake and Sandhole Lake can hold large numbers of geese in fall; Rays Lake is located within the proposed elk hunting area. Typically these geese leave the Refuge shortly after first light to feed and may return to rest and drink about mid-morning. They will typically leave again in late afternoon to feed, and return at dark daily.

Periodic firearm discharge in close proximity to wetlands can result in behavioral responses by waterfowl and other wetland birds. Portions of the Refuge proposed to be open to elk hunting would include Rays Lake, which holds Canada geese in late summer and early fall. Periodic shooting, or hunters walking in close proximity to these wetlands, could temporarily disperse birds. This disturbance would be limited in scope by the low number of hunters at any given time (maximum of two daily). The rate of gunfire discharge is expected to be infrequent and random based upon opportunistic individual shots at elk in range. The frequency of gunfire may be only a few shots per day at most, causing temporary and short-term disturbance to waterfowl.

The controlled elk hunt has the potential to disturb greater sandhill cranes, which use Rays Lake (which is located in the proposed hunt area) and to a lesser extent, Sandhole Lake (outside the hunt area) as roost sites during pre-migration staging. Sandhill cranes present at Camas NWR are from the Rocky Mountain population, which stage in specific locations throughout their summer range during late August to early October. Normally, crane numbers peak at specific staging areas in September but timing varies somewhat by area and year. The September pre-migration survey is the best opportunity to survey the population (Subcommittee on Rocky Mountain Greater Sandhill Cranes 2007). Since 1995, the IDFG has gathered data on summer populations and September staging areas to comply with management plan requirements. The largest staging areas in Idaho are the Teton Basin, Grays Lake, and the Ashton-St. Anthony area (1992-2005 data). Camas NWR is a mid-sized staging area and one of only six staging areas in Idaho with pre-migration survey counts of more than 500 cranes. 1992-2009 data from Camas NWR, which combine both aerial and ground count (except for 2006 when aerial surveys were not conducted), are provided in the table below.

September Population Estimates of Greater Sandhill Cranes at Camas NWR, from Fall Pre-migration Surveys

Year	Crane Count
1992	131
1995	229
1996	212
1997	418
1998	268
1999	192
2000	429
2001	257
2002	331
2003	347
2004	381
2005	532
2006	313*
2007	632
2008	475
2009	806

*Aerial surveys not conducted in 2006.
Source: IDFG 2009.

In typical years, crane numbers at Camas NWR peak in mid-September and the majority of cranes have left the Refuge by early October. However, during open winters (no snow), low numbers of cranes have been observed on the Refuge into December. Staging cranes can be found on various types of habitat on the Refuge including dry upland sites, hayed areas, and agricultural fields. In September, large numbers of cranes roost on Rays Lake; lower numbers may use Sandhole Lake. Typically, cranes prefer Rays Lake for roosting due to its shallower water. Cranes typically leave the Refuge twice a day (early morning and again in the evening) to forage in grain fields in the local area and return to the Refuge to roost. A smaller number feed in agricultural fields located on the Refuge (refuge grain fields are located outside the hunt area).

Sandhill cranes have shown susceptibility to even low levels of disturbance at roost sites (Bettinger and Milner 2000; Littlefield and Ivey 2000). Observations of numerous roosting sites by Lewis (1976) and Lovvorn and Kirkpatrick (1981) indicated that roosts were characterized by level terrain, shallow water bordered by a shoreline either devoid of vegetation or sparsely vegetated, and an isolated location that reduces potential for disturbance by humans. Pedestrian and vehicle traffic can potentially disturb breeding and roosting cranes (Engler 2000; Kramer et al. 1983; Norling et al. 1992). Bettinger and Milner recommend that "Hunting activity should be avoided near established roosts, or restricted to 4 hours after sunrise until 2 hours before sunset."

Because of the sensitivity of roosting cranes to disturbance, hunters would be advised of the location of sandhill cranes during their pre-hunt orientation and would be required to maintain a distance of at least 400 meters (¼ mile) from roosting cranes while in pursuit of elk. The framework of the refuge hunt additionally allows the Refuge to selectively close areas, as detected, to protect sensitive wildlife resources within the hunt area with spatial buffers. Resource buffers would be used to sufficiently safeguard sandhill crane roost sites from abandonment. As closures are implemented, the Refuge would supply hunt permit holders with maps of closures to hunting activity.

Disturbance of trumpeter swans with broods is a potential concern during the early portion of the elk hunting season. The young of trumpeter swans typically hatch in late June, however nesting, laying, hatching, and fledging dates of trumpeter swans vary widely even within areas, due to annual weather patterns. There is as much variation between years at individual sites as between different regions (Mitchell and Eichholz 2010). For example, Gale et al. (1987) give first hatching dates at Red Rock Lakes NWR, MT, between May 30 and July 1 in different years, while within-year hatching dates varying by 1-3 and, exceptionally, 6 weeks. Nesting and laying is delayed in cold, wet years (Cooper 1979; Page 1976; Shea 1979). Cygnets fledge at 84-122 days, typically at 99-102 days (Banko 1960; Hansen et al. 1971; Kraft 1991; Simon 1952; Wilmore 1979), and remain with their parents through their first winter (Ehrlich et al. 1988; Gale 1989). Therefore in typical years swans would be fledged by mid-October, but in years with late nesting, swans with cygnets could be present as late as November 1, although this is unlikely given the lack of late season water in the areas of the Refuge used by swans for brood rearing.

Due to swan sensitivity to human disturbance, wetlands otherwise suitable for trumpeter swan but subject to disturbance by human activity, are likely to be avoided by swans, reducing overall habitat availability. Loud noise from motorized recreational activities, such as boats, all-terrain vehicles, float planes, and motorcycles, can disturb nesting swans (Gale et al. 1987; Henson and Grant 1991). If breeding areas are intruded on frequently, swans may abandon their nest and eggs (Mitchell 1994). Motorized disturbances from public visitation and hunters, if sustained and excessively loud, could alter swan behavior, particularly of females, leading to increased probability of nest predation, egg mortality, delayed development of exposed eggs, or insufficient care to cygnets. Henson and Grant (1991) found that undisturbed females always covered eggs prior to leaving the nest, took shorter recesses from the nest, and spent more time feeding and preening while away from the nest compared to disturbed females who failed to cover eggs 26 of 28 times they recessed from the nest. A frequent cause of disturbance occurs when vehicles stop along roadsides or honk their horns; however, vehicle traffic alone is probably not a serious problem in most locations (Henson and Grant 1991) and is not expected to increase greatly at Camas NWR from issuance of up to 20 annual refuge elk hunting access permits.

Non-motorized human activities elicit the greatest response by swans during the breeding season (Henson and Grant 1991). Pedestrians cause disturbance to trumpeter swans by disrupting adults, causing short- or long-term nest abandonment, and resulting in displacement from breeding areas (Bangs et al. 1982; Banko 1960; Hansen et al. 1971; Henson and Grant 1991; Page 1976; Shea 1979). Pedestrian hunters can also influence incubation and brood rearing behavior and contribute to nest failure or death of cygnets (Gale et al. 1987; Henson and Grant 1991; Holton 1982). Although visual barriers such as vegetation and hills situated between sources of disturbance and nesting swans may serve to decrease the impact of disturbances, swans are known to respond to noises made by humans even when they were not visible (Henson and Grant 1991). Henson and Grant (1991) recommend that wildlife viewing areas should be concealed in vegetation, designed to minimize noise of users, and located at a distance greater than 300 m (984 feet) from swan nests. The proposed elk hunt could disturb trumpeter swans and their broods during the early portion of the hunting season. However, disturbance of trumpeter swans by elk hunters is unlikely due to the fact that the hunt area, and the area where elk spend the bulk of their time, lies outside the area where swan nesting and brood rearing has historically occurred.

There is little information about the effects of human activities to swans on wintering or migratory staging grounds. However, those human activities that disturb swans on breeding grounds likely affect swan behavior on wintering or migratory staging grounds. Disturbances to swans that disrupt winter or migratory foraging activities or cause frequent movements from resting areas may decrease overall condition or even cause mortality (Mitchell 1994). Swans in poorer condition during migration or on the wintering grounds may have higher mortality during a severe winter event or epizootic outbreaks (Anderson et al. 1986). In a particularly wet year the Refuge anticipates that pedestrian access from elk hunters could disturb some foraging swans in the Rays Lake area. However, water is seldom in Rays Lake on an average or dry year and swans collectively spend little time in the 4,112 acre elk hunting area. There is no documentation of swans nesting or rearing broods in the proposed elk hunt area. Furthermore, during the required pre-hunt orientation hunters would be advised of the current locations of swans. Elk hunters would be required to maintain at least a 400 meter (¼ mile) distance from wetlands where swans are rearing their broods. As noted above, the framework of the refuge hunt allows the Refuge to selectively close areas, as detected, to protect sensitive wildlife resources within the hunt area with spatial buffers.

Impacts to Other Wildlife-dependent Recreational Uses:

Hunting (especially gunshot noise) has the potential to disturb refuge visitors engaged in other priority public uses. Camas NWR also provides a variety of recreational opportunities for an estimated 6,000 to 7,000 annual visitors, who are principally interested in non-hunting wildlife experiences. Camas NWR has its highest visitation during the spring waterfowl migration, in particular when good numbers of snow geese are roosting on refuge wetlands. The second highest visitation seasons appears to happen during the white-tailed deer breeding season as many photographers visit to take photos of the deer as they are highly visible during the rut.

The Refuge offers a mix of wildlife-dependent uses, i.e., wildlife observation, photography, hunting, interpretation and education, and non-wildlife-dependent uses (i.e., hiking, biking, snowshoeing, and cross-country skiing) that can be negatively impacted by the proposed elk hunt. The 6.3-mile refuge auto tour route, 1.3-mile birding trail and observation deck where the majority of nonconsumptive uses occur are all in the “no hunting” area and outside the elk hunt unit boundary. Wildlife observation and photography, walking, bicycling, snowshoeing, and cross-country skiing may occur on approximately 5 miles of service roads and 5 miles of hunter access roads within the hunt area. To ensure visitor safety, these roads would be clearly marked to inform visitors that they are entering an elk hunting area and do so at their own risk. We would expect that this would discourage some visitors from using the hunt area during the hunting season; however, this effect is considered minor in the context of refuge wildlife observation areas available over the course of the year; the year-round availability of approximately 22 miles of service roads outside the elk hunt area; and the fact that few visitors currently use the proposed elk hunt area.

Providing orientation to all hunters would also help eliminate possible use conflicts. Enforcement of existing State regulations that prohibit discharge of firearms from or across public right of ways, would minimize risk of trajectories into the non-hunting portion of the Refuge. With a maximum of 20 big game hunters permitted annually and only a maximum of two hunters using the Refuge at any one time, conflicts with non-consumptive users should be minimal and only result in a minor negative effect to recreational wildlife observation and photography opportunities.

While the general assumption is that elk hunting may have a minor negative effect on refuge wildlife observation and photography opportunities, it is also possible that wildlife observation and photography opportunities could be increased as animals move away from the hunted zones toward no hunting zones. However, it is also possible that hunters could move animals off the Refuge entirely, decreasing opportunities to observe and photograph elk during the hunt season. Due to uncertainties in the response of wildlife to refuge hunting disturbance, the Refuge has developed strategies to work with Idaho Department of Fish and Game to re-assess the effectiveness of the elk hunt every five years and re-evaluate the hunt related to both consumptive and non-consumptive recreational objectives for the Refuge.

Impacts to Adjacent Lands

The initiation of an elk hunting program on Camas National Wildlife Refuge would result in additional localized gunfire along the southern and western portions of the Refuge, adjacent to private farmlands (south border) and BLM lands on the western border where hunting already occurs. Hunting on the Refuge would occur simultaneously with the local off-refuge controlled elk hunt, representing a slight increase in gunfire above the current baseline. Enforcement of existing State regulations that prohibit discharge of firearms from or across public right of ways, would minimize risk of trajectories into non-hunting portions of the Refuge or onto adjacent private property. The requirement that hunters use only shoulder fired, center fire weapons with cartridges larger than 20 caliber is intended to ensure clean kills and reduce the likelihood of wounded game moving off the Refuge.

The proposed hunt would help reduce the local elk population to alleviate agricultural depredation to lands surrounding the Refuge. The elk hunt is anticipated to have a minor positive economic impact by reducing financial losses due to crop depredation.

Summary and Application to Camas NWR:

The proposed elk hunt on Camas NWR may cause declines in the local elk population (GMU 63). However this is consistent with IDFG management of the GMU 63 elk herd, with liberal hunting seasons directed at lowering herd size and thereby lowering depredation complaints. The impact of the refuge hunting program on regional or statewide elk populations is likely to be inconsequential. While hunting has no positive effects on elk as the activity is occurring, it is well recognized that this activity has given many people a deeper appreciation of wildlife and a better understanding of the importance of conserving their habitat, which has ultimately contributed to the Refuge System mission.

Public Review and Comment:

Public review and comments are being solicited in conjunction with release of this Draft CCP/EA (USFWS 2013) in order to comply with the National Environmental Policy Act and with Service policy. Public review of a step down Hunt Plan (see Stipulations), as required under Service policy, is being conducted concurrently with public review of the Draft CCP/EA, before implementing the refuge elk hunting program.

Determination:

____Use is Not Compatible

_X__Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

User Stipulations for All Elk Hunters:

- Each hunter will secure and possess the required State hunting licenses and elk tags.
- Each hunter will comply with the applicable provisions of all State and Federal laws as well as hunting regulations of the State of Idaho.
- Hunters may enter the Refuge 1 hour before shooting time and must leave within 1 hour after shooting time ceases.
- Only those firearms identified for that specific hunting season are allowed.
- It is unlawful to shoot from or across the traveled portion, shoulders, or embankments of any road maintained by any government entity.
- Motorized vehicles will be limited to designated parking areas, with access walk-in from parking lots, except as may be permitted on open roads to remove harvested elk.
- Camping, overnight use, and fires are prohibited.
- No ATVs are allowed on the Refuge.
- No overnight parking is allowed.
- No trapping is allowed.
- It is unlawful to use or possess alcoholic beverages or drugs while on Camas National Wildlife Refuge.
- Individuals may possess, carry and transport, concealed, loaded and operable firearms on the Refuge in accordance with all provisions of state and local law.
- Persons may only use (discharge) firearms in accordance with Refuge regulations (50 CFR 27.42 and specific Refuge regulations in 50 CFR 32).
- Target shooting and sighting-in weapons are not permitted.
- Unless declared as open, all other forms of hunting are prohibited.
- Unless a valid permit (migratory or upland game bird hunting license or big game access permit) allows legal entry on to the Refuge for that season, retrieval of the animal is prohibited.

Big Game Regulations Specific to Camas NWR:

- State of Idaho hunting license, GMU 63 elk tag, and Refuge access permit are required.
- Elk hunting access permit information and applications for the drawing will be available at Camas NWR office. Elk hunting access permit applications must be submitted by the second Friday in July of each year. The draw for permits will occur on the following Monday. Selections will be made by a random draw.
- Refuge access permits for elk hunting allow access on Fridays, Saturdays, Sundays, Mondays and Tuesdays within an assigned two-week period, until an elk is harvested. Upon receiving the permit, the permittee must contact the Refuge to set up a hunt date at least seven days before the hunter's arrival. Hunt dates will be reserved on a first come, first serve basis with priority going to disabled, mobility impaired hunters and youth hunters (hunters aged 12-17). Permits may not be transferred.

- Before each hunt, Refuge staff or a trained Refuge volunteer will provide an orientation describing the hunt procedures, description of hunt area, an overview of special Refuge regulations, safety reminders, description of non-target wildlife and a check of licenses/permits.
- Elk hunters may enter Refuge 1 hour before shooting time begins and must leave within 1 hour after shooting time ceases, unless retrieving an elk.
- Refuge elk hunting hours will coincide with the state hunting hours for big game, currently ½ hour before sunrise to ½ hour after sunset.
- No dogs are allowed for elk hunting activities.
- Shooting into any Closed Area is prohibited.
- Hunters (or designated assistants of mobility impaired hunters) must be accompanied by Refuge staff or trained volunteer when entering areas of the Refuge that are closed to hunting in order to retrieve elk.
- Elk hunters may only use a shoulder fired weapon, using only center fire cartridges larger than 20 caliber.
- All persons participating in the hunt must wear a minimum of 500 square inches of fluorescent orange material above the waistline, which is visible, from all directions. A vest and hat normally meet this requirement, a hat alone does not.

Youth Elk Hunt Regulations Specific to Camas NWR:

- Participants in the youth hunt must be accompanied by, and in the immediate presence of a non-hunting adult.
- Applicants must be at least 12 years of age but not 18 years of age at the time of the hunt application.

Mobility Impaired Elk Hunt Regulations Specific to Camas NWR:

- State of Idaho disabled hunting license, GMU 63 elk tag and Refuge mobility impaired access permit is required.
- To receive a Refuge mobility impaired access permit, hunters meet at least one of the following Refuge-specific criteria: 1) Mobility impairment resulting from permanent medical conditions which makes it physically impossible for them to hunt without the assistance of an attendant; 2) Need a medically prescribed assistive device for mobility; or 3) be at least 65 percent disabled.
- Mobility impaired hunters may be accompanied by a non-hunting assistant, designated in writing in accordance with State regulations.
- Mobility impaired hunters may use portable blinds. Hunting from vehicles is prohibited.

Other Stipulations:

- Hunt areas would be posted at least two weeks before the hunting season begins.
- Southeast Idaho Refuge Complex staff would conduct law enforcement, maintain hunting facilities, and monitor wildlife impacts.

Justification:

This use has been determined compatible provided the above stipulations are implemented. This use is being permitted as it is a priority public use and would not interfere with the Refuge achieving its purposes of providing “a refuge and breeding ground for migratory birds and other wildlife” and the “… conservation, management, and … restoration of the fish, wildlife, and plant resources and their habitats … for the benefit of present and future generations of Americans….” The hunting of elk on the Camas NWR would contribute to the mission of the National Wildlife Refuge System by providing a wildlife-oriented recreational benefit to Americans. Hunting is also one of the six wildlife-dependent recreational uses of the National Wildlife Refuge System as stated in the National Wildlife Refuge System Improvement Act of 1997.

Hunting does result in the taking of individuals within the overall population; however, resident game hunting seasons and bag limits are established by the State of Idaho, ensuring the continued well-being of overall populations within the State. Consistent with the System mission, hunting on NWRs results in management of populations and is not a “control” program intending to eliminate certain species for the benefit of others; however we may conduct hunting programs for resident wildlife species in accordance with State objectives (which in this case includes reducing depredation complaints) if this does not materially detract from or interfere with the purposes for which the Refuge was established.

It is anticipated that wildlife populations would find sufficient food resources and resting places such that their abundance and use of the Refuge would not be measurably lessened from allowing elk hunting to occur on the Refuge. The relatively limited number of individuals expected to be adversely affected by elk hunting on Camas NWR would not cause wildlife populations to materially decline, the physiological condition and production of wildlife species would not be impaired, their behavior and normal activity patterns would not be altered dramatically, and their overall welfare would not be negatively impacted. Thus, allowing elk hunting to occur with stipulations would not materially detract or interfere with the Refuge’s purposes or the Refuge System mission.

Mandatory Re-Evaluation Date (provide month and year for “allowed” uses only):

2029 Mandatory 15-year Re-evaluation date (for priority public uses)

____ Mandatory 10-year Re-evaluation date (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision:

____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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Signatures for Compatibility Determination 4, Elk Hunting on Camas NWR:

Prepared by: ________________________________ ____________
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: ________________________________ ____________
(Signature) (Date)

Concurrence

Refuge Supervisor: ________________________________ ____________
(Signature) (Date)

Regional Chief,
National Wildlife
Refuge System (for
HI, ID, OR,
PI, and WA): ________________________________ ____________
(Signature) (Date)

B.8 Draft Compatibility Determination for Research and Monitoring on Camas National Wildlife Refuge

RMIS Database Uses: Research and Monitoring

Refuge Name: Camas National Wildlife Refuge (NWR)

Location: Jefferson County, Idaho

Date Established: 1937

Establishing and Acquisition Authorities:

- Executive Order 7720, signed October 8, 1937, dated October 8, 1937
- Migratory Bird Conservation Act of 1929, as amended (16 U.S.C. § 715 et seq.)
- National Wildlife Refuge System Administration Act (16 U.S.C. § 668dd et seq.)

Refuge Purpose(s):

- "… as a refuge and breeding ground for migratory birds and other wildlife." (Executive Order 7720, dated Oct. 8, 1937)
- "… for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. § 715d (Migratory Bird Conservation Act)
- "… conservation, management, and … restoration of the fish, wildlife, and plant resources and their habitats … for the benefit of present and future generations of Americans… " 16 U.S.C. § 668dd(a)(2) (National Wildlife Refuge System Administration Act)

National Wildlife Refuge System Mission:

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

Description of Use:

The refuge staff receives periodic requests from non-Service entities (e.g., universities, State 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, 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, would be given a higher priority over other requests.

Availability of Resources:

Refuge staff responsibilities for projects by non-Service entities would 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 would 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 would 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 would 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		$1,000
Monitoring		$1,000
Special equipment, facilities, or improvement		$0
Offsetting revenues		$0

Itemized costs in the previous table are current estimates calculated using a 3 percent base cost of a GS-12 refuge manager.

Anticipated Impacts of Described Use:

Use of the Refuge to conduct research, scientific collecting, and surveys would generally provide information that would 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 would 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 would 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 C.F.R. 29.1).

Impacts would be project- and site-specific, where they would vary depending upon nature and scope of the fieldwork. Data collection techniques would 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 would have short-term impacts. To reduce impacts, the minimum number of samples (e.g., water, soils, vegetative litter, plants, macroinvertebrates, vertebrates) would be collected for identification and/or experimentation and statistical analysis. Where possible, researchers would 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 and Federal collecting permits would also ensure minimal impacts to fish, wildlife, plants, and their habitats. If after incorporating the above strategies, projects would not be compatible if they would result in long-term or cumulative effects. A Section 7 consultation under the Endangered Species Act (16 U.S.C. 1531-1544, 87 Stat. 884, as amended Public Law 93-205) would be required for activities that may affect a federally listed species and/or critical habitat. Only projects which have no effect or would result in not likely to adversely affect determinations would be considered compatible. Currently, no listed species occur on Camas NWR.

Spread of invasive plants and/or pathogens is possible from ground disturbance and/or transportation of project equipment and personnel, but it would 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 would 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 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) would usually be localized and temporary in nature. Where long-term or cumulative unacceptable effects cannot be avoidable, the project would not be found compatible. Project proposals would 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 six months before initiation of fieldwork (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 would 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 would form the primary basis for allowing or denying a specific project. Projects which result in unacceptable refuge impacts would not be found compatible. If allowed and found compatible after approval, all projects also would be assessed during implementation to ensure impacts and conflicts remain within acceptable levels.

If the proposal is approved, then the refuge manager would 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) would 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 would 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 Refuge's Inventory and Monitoring Plan, or inventory and monitoring strategies under the objectives in this CCP would require additional NEPA documentation.

Public Review and Comment:

Public review and comments are being solicited in conjunction with release of this Draft CCP/EA (USFWS 2013) in order to comply with the National Environmental Policy Act and with Service policy.

Determination:

____Use is Not Compatible

_X__Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

Each project would require a SUP. Annual or other short-term SUPs are preferred; however, some permits would be a longer period, if needed, to allow completion of the project. All SUPs would have a definite termination date in accordance with 5 RM 17.11. Renewals would be subject to refuge manager review and approval based on timely submission of and content in progress reports, compliance with SUP stipulations, and required permits.

- Projects would adhere to scientifically defensible protocols for data collection, where available and applicable.
- Investigators must possess appropriate and comply with conditions of State 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 the Refuge.
- Progress reports are required at least annually for multiple-year projects. The minimum required elements for a progress report would 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 would require approval by the refuge manager.
- The refuge staff would 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 would be provided with copies (reprints) of all publications resulting from a refuge project.
- The refuge staff would 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 would 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 would require submission of a subsequent proposal for review and approval. In addition, a new SUP would be required for additional project work. For samples or specimens to be stored at other facilities (e.g., museums), a memorandum of understand would be necessary (see Attachment 3).
- Sampling equipment as well as investigator(s) clothing and vehicles (e.g., ATV, boats) would be thoroughly cleaned (free of dirt and plant material) before being allowed for use on refuge lands to prevent the introduction and/or spread of pests. Where necessary, use quarantine methods (see Attachment 4).
- The NWRS, the specific Refuge, names of refuge staff and other Service personnel that supported or contributed to the project would 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 would 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 would expand scientific information available for resource management decisions. In addition, only projects that directly or indirectly contribute to the enhancement, protection, use, preservation, and management of refuge wildlife populations and their habitats generally would 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 would find sufficient food resources and resting places so their abundance and use would not be measurably lessened on the Refuge.

Additionally, it is anticipated that monitoring, as needed, would prevent unacceptable or irreversible impacts to fish, wildlife, plants, and their habitats. As a result, these projects would not materially interfere with or detract from fulfilling refuge purpose(s); contributing to the mission of the NWRS; and maintaining the biological integrity, diversity, and environmental health of the Refuge.

Mandatory Re-evaluation Date: (provide month and year for “allowed” uses only)

____ Mandatory 15-year Re-evaluation date (for priority public uses)

2024 Mandatory 10-year Re-evaluation date (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision:

____Categorical Exclusion without Environmental Action Statement

____Categorical Exclusion and Environmental Action Statement

_X_Environmental Assessment and Finding of No Significant Impact

____Environmental Impact Statement and Record of Decision

References:

USFWS (U.S. Fish and Wildlife Service). 2013. Environmental assessment for the draft refuge comprehensive conservation plan, Camas National Wildlife Refuge. On file at Camas Refuge. Hamer, ID.

Signatures for Compatibility Determination 5, Research and Monitoring on Camas National Wildlife Refuge:

Prepared by: ______________________________ ___________
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: ______________________________ ___________
(Signature) (Date)

Concurrence

Refuge Supervisor: ______________________________ ___________
(Signature) (Date)

Regional Chief,
National Wildlife
Refuge System: ______________________________ ___________
(Signature) (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 six 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 would 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 principal 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 would 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 would 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 would 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 would 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 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 would 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 would 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(s). 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 six months prior to their proposed study period.

One of the gravest threats to the Refuge(s) 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 Refuge(s).

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(s), and which have been stored in a quarantined environment between trips to the Refuge(s).
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 would not harbor seeds or insects. Packing containers may be re-used for multiple trips to the Refuge(s), but must be thoroughly cleaned before each trip and strictly dedicated to refuge-related projects.
    a. 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.
    b. 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(s) 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) would be inspected for quarantine compliance by Service staff prior to entering the Refuge(s) and again before departing the Refuge(s). A concerted effort would be made to ensure that alien pests are not transported. Service staff on the Refuge(s) would inspect outbound cargo prior to transport.

E. Prohibited Items (Transport of the following items are strictly <u>prohibited</u>)

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 <u>regulated</u>)

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(s). Foods would not be allowed on the Refuge(s) 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(s). 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(s), 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(s) 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.

B.9 Draft Compatibility Determination for Agricultural Practices (Farming and Haying) on Camas National Wildlife Refuge

RMIS Database Uses: Agriculture (Farming and Haying)

Refuge Name: Camas National Wildlife Refuge (NWR)

Location: Jefferson County, Idaho

Date Established: 1937

Establishing and Acquisition Authorities:

- Executive Order 7720, signed October 8, 1937, dated October 8, 1937
- Migratory Bird Conservation Act of 1929, as amended (16 U.S.C. § 715 et seq.)
- National Wildlife Refuge System Administration Act (16 U.S.C. § 668dd et seq.)

Refuge Purpose(s):

- "… as a refuge and breeding ground for migratory birds and other wildlife." (Executive Order 7720, dated Oct. 8, 1937)
- "… for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. § 715d (Migratory Bird Conservation Act)
- "… conservation, management, and … restoration of the fish, wildlife, and plant resources and their habitats … for the benefit of present and future generations of Americans… " 16 U.S.C. § 668dd(a)(2) (National Wildlife Refuge System Administration Act)

National Wildlife Refuge System Mission:

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

Description of Use:

Camas NWR began to produce crops for waterfowl and forage for livestock in the early 1940s, and by 1947, 240 acres of the Refuge were being farmed for grain production. The intensity of the refuge farming program increased in the 1950s. In 1950, 160 acres of new ground were broken for grain production. By the mid to late 1960s, approximately 500 acres of land on the Refuge had been leveled to increase the production of small grain crops. One of the reasons for this major increase in cropping was to support the Animal Damage Control (ADC) program, and the trumpeter swan and whooping crane recovery programs at Red Rock Lakes NWR and Grays Lake NWR in the 1970s. In 1977 Camas NWR was relieved of these duties, and grain production was immediately reduced. By 1981 only 160 acres of refuge lands were still in crop production. By the late 1980s cropped acres had been further reduced to 70 acres. From the late 1980s to the present day, acres in crop production have ranged from 120 to 160 acres, with most of the acreage in alfalfa.

Most of the Refuge's fifteen active hay units (250 acres) have had a farming history associated with the production of small grains to support trumpeter swan and whooping crane recovery projects. When these programs ended in the mid-1970s Camas NWR scaled back on small grain production. Formerly farmed fields on the Refuge were taken out of production and allowed to revert back to introduced pasture grasses (e.g., smooth brome and quackgrass). In most recent history these areas have been hayed through Cooperative Land Management Agreements.

Current Management:

Cooperative agriculture (farming and haying) is a management tool that allows the Refuge to provide forage and habitat for migratory birds and resident wildlife. The Refuge uses Cooperative Land Management Agreements (CLMAs) for crop production. CLMAs are negotiated agreements between the Refuge and a private party, and are used to implement cooperative programs that help achieve refuge purposes as well as provide an economic benefit to the farmer. Under refuge CLMAs, private farmers (cooperators) raise a refuge-specified crop in a designated field or fields, and are entitled to remove a portion of the crop from the Refuge in exchange for farming the agricultural crop. CLMA holders use their own farm equipment such as tractors, swathers, balers, and diskers. The cooperator is responsible for all the costs of production.

<u>Current cooperative farming use:</u> Currently, the Refuge uses CLMAs with local farmers to implement the refuge farming program. Cooperators front the cost of small grain operations (e.g., mechanical preparations, watering, seeding, labor costs) in exchange for harvesting a portion of the refuge alfalfa crop.

Cooperative farming occurs on two separate 80-acre tracts of land. The northernmost field (Well #7 field) has 60 acres of irrigated alfalfa and 20 acres of irrigated small grain. The field in the southwestern corner of the Refuge (Well #9 field) is currently 80 acres of irrigated alfalfa only.

Cooperative farmers use refuge-owned irrigation equipment (wheel lines and well head) in the Well #7 Field, and their own privately owned irrigation equipment (wheel lines) in the Well #9 Field. After two years of being planted in small grain, fields are rotated into a 6-year planting of alfalfa. Small grain planting is initiated before irrigation of alfalfa begins to conserve water resources and irrigate planted small grain in conjunction with alfalfa. Strips of small grain are mowed as they mature in the late summer or early fall to provide forage base for migrating birds while alternating strips are left standing.

Irrigated alfalfa is swathed and baled in late summer, with the final timing of the harvest occurring at the discretion of the cooperator, based upon the maturity of the alfalfa. Alfalfa fields are disced and planted in fall to re-establish an alfalfa planting just prior to seeding to lessen the amount of soil lost to wind erosion.

Refuge grain crops provide a supplemental on-refuge forage base to meet carbohydrate and protein requirements of waterfowl (primarily Canada goose and mallard) and sandhill cranes during migration. Croplands on refuge and State WMA lands promote sustained use of these areas by migrating waterfowl by providing an accessible, high-energy food source during late fall and early winter as wetlands freeze up. This reduces waterfowl depredation on adjacent croplands.

Alfalfa benefits a variety of species including white-faced ibis, Swainson's hawk, long-billed curlew, Canada goose, mallard, greater sandhill crane, and greater sage-grouse at various stages in their life histories. It provides sustained green browse for waterfowl and cranes throughout the migratory spring and fall seasons. In addition alfalfa provides leafy browse for sage grouse during the brood-rearing season, invertebrates for long-billed curlew and white-faced ibis, and small rodents for Swainson's hawks, especially after the alfalfa has been harvested.

All crop selections are agreed to by the Refuge, and special conditions are documented in the CLMA. Genetically modified crops are not allowed; however, fertilizers and soil amendments can be used by the Cooperator. Small grain crops are fertilized by broadcasting granular nitrogen fertilizers during planting or prior to barley jointing. Lime is applied 6 months before the actual planting date to affect soil pH by planting time.

Refuge personnel apply herbicides on farmed units through force account (refuge) funding as-needed to control invasive species. Weed control methods are used as necessary to improve the growth of desirable vegetation and reduce competition from weed species. Preventing infestations is the most effective strategy. Early detection followed by rapid response (ED/RR) helps prevent new invasive plant occurrences from becoming established. The refuge staff and cooperators conduct searches of refuge lands and waters regularly to identify new occurrences and implement efforts to control and eradicate these species. The Refuge uses an integrated pest management (IPM) approach to control weeds (Appendix F), whereby management options are selected based on-site conditions. All applications of herbicides conform to the specific pesticide label requirements. The Refuge reviews pesticide use annually and submits pesticide use proposals for all applications conducted on refuge lands. The use of insecticides, fungicides, and other chemicals is not permitted.

Current cooperative haying use: Currently the Refuge has fifteen units (approximately 250 acres) of former farmed fields (upland and wet meadow habitat) that are available to be hayed. Haying is conducted by cooperators. Typically only one cooperator or permittee is necessary to meet targeted acres. All hay units are irrigated. Approximately 150 acres are hayed annually. Which units are hayed is determined in late spring/early summer, based upon water management patterns, recent precipitation, forage quantity and quality, and what the use pattern was the previous year. A July 15 start date for haying is necessary to minimize impacts to nesting grassland birds and to treat invasive species prior to seed set. All haying must be completed and bales must be removed from the Refuge by August 30.

Proposed Management:

In the Preferred Alternative, refuge farming and haying would continue under similar authorities and stipulations as current management. The Refuge would continue to use best management practices (see Stipulations below). Special conditions currently in place would continue, including additional restrictions on pesticide uses, limits to the types of crops grown, and no haying until after July 15 to reduce the risk of destroying nests of ground nesting birds. Proposed changes to the farming and haying program are as follows.

Proposed farming management: We propose to continue the current cooperative farming program, with 160 acres within the Well #7 field (80 acres, of which 20 are small grain and 60 acres alfalfa) and the Well #9 field (80 acres of irrigated alfalfa). The Refuge would continue to use cooperative farming agreements with area farmers to plant agricultural fields using refuge-owned irrigation equipment (Well #7 Field) and privately owned irrigation equipment (Well #9 Field). Agriculture fields would continue to be rotated after two consecutive years of cropping small grains into a six-year alfalfa planting. Should the current cooperative farmer decide to no longer farm on the Refuge and remove his irrigation equipment, the Refuge would attempt to purchase irrigation equipment and continue to cooperatively irrigate and farm the Well #9 Field. Should the Refuge be unable to acquire irrigation equipment, rotational dryland farming practices would be implemented on the Well #9 Field for 20-40 acres of dryland grain and 20-40 acres of dryland alfalfa. The Refuge would annually evaluate workforce to determine the efficacy of CLMAs in comparison to the Refuge undertaking agricultural plantings through force-account funding.

The Refuge would implement measures to reduce soil erosion and ensure that the minimum necessary amount of fertilizers and other chemicals are used. The Refuge would conduct periodic soil tests and work with cooperative farmer to apply proper fertilization and liming treatments, as necessary, to maintain proper nutrient and pH levels for productive agriculture plantings. Applications of anhydrous ammonia fertilizer would be prohibited, to minimize the presence of excessive environmental nitrogen accumulations and concerns for refuge soil and water resources. Since wind erosion is a major issue in the northern Snake River Plain, the Refuge would use conservation tillage practices and avoid fall tillage for spring plantings. Planting would be initiated immediately after plowing and disking of small grain fields to lessen the amount of soil lost to wind erosion. We would attempt to till and plant both grain and alfalfa crops across the slope, rather than with the slope of the land to reduce erosional forces on soil. Winter wheat or rye may be used as companion plantings with alfalfa to decrease weed establishment and reduce the need for herbicides. Old alfalfa stands would be rotated to cereal grains every six years or when density of alfalfa reaches 0.75 plants per square foot. We would evaluate the potential to increase the duration of alfalfa coverage longer than six years within established and maintained fields via either increased winter fertilization, increased seeding rates, or decreased spacing between plant rows.

Small grain crops would be planted in blocks of rows running perpendicular to one another to ensure that the tops of some rows would be exposed by the prevailing winds during heavy snow, thus ensuring the availability of grain for wildlife. In addition to mowing alternating swaths of grain, the Refuge would mow wide swaths of mature small grain crops, separated by several rows of unharvested crops, thereby providing a “snow fence” to enhance the availability of grain on the ground as well as provide a reserve of food that would remain above even the deepest early snows. Grasses adjacent to alfalfa fields would be mowed to maintain short vegetation along the agriculture field interface to provide both additional green forage and visual security from predators. Finally, the Refuge would annually survey and monitor wildlife use within refuge agriculture crops to assess benefits or impacts from the refuge farming program for wildlife.

Proposed haying management: We propose to continue managing 250 acres of hay units, and allowing haying of 150 acres of wet meadow and upland habitat annually, by cooperators or permittees. However, only 150 acres of hay units would be irrigated annually, and the refuge manager would work with the haying cooperator or permittee to delay haying until after July 15 if necessary to protect ground-nesting birds. Haying would be rotated through different parcels, so that the same units would not get hayed two years in a row. The Refuge would conduct prescribed fire and other IPM activities, and reseeding of hay units. These strategies would provide a mixture of short-grass foraging habitat for species such as Canada geese and sandhill cranes, and dense grass nesting cover for waterfowl. Rotational haying would also allow time for hay units to recover, increasing both the forage quality and quantity of hayed units.

Need and Availability of Resources:

Category and Itemization	One-time ($)	Annual ($/yr)
Administration and management:	$0	$3,000
Equipment/ Equip. Maintenance:	$2,000	$0
Mowing and herbicides (crop fields)		$2,000
Irrigation, IPM, prescribed fire, reseeding (hay units)		$11,550
Monitoring:	$0	$500
Offsetting revenues:	$0	−$3,000
TOTALS	$0	$14,050

Anticipated Effects of Described Use:

Farming

Effects of farming to refuge wildlife: Both current and proposed management recognize the benefits for providing supplemental forage for migratory waterfowl and waterbirds. Refuge farming practices (both current and proposed) are designed for the predominant benefit of waterfowl (ducks and geese) and greater sandhill cranes. However, many other species (e.g., long-billed curlews, white-faced ibis, sage-grouse, Swainson's hawk) benefit directly or indirectly from refuge alfalfa crops. Grain crops on the Refuge promote sustained use of the area by migrating waterfowl by providing an accessible, high-energy food source during late fall and early winter as wetlands freeze up.

Most waterfowl are opportunistic feeders, and some species such as Canada geese, snow geese, mallard, northern pintails, and teal have learned to capitalize on the abundant foods produced by agriculture (Bellrose 1976). During the last century, migration routes and wintering areas have changed in response to availability of these foods (Fredrickson and Drobney 1979). Some species have developed such strong migratory traditions that many populations are now dependent on agricultural foods for their migration or winter survival (Ringleman 1990). During fall, winter, and early spring, when vegetative foods make up a large part of their diet, agricultural foods are preferred forage except in arctic and subarctic environments (Sugden 1971).

Agricultural foods such as small grains, most of which are neither nutritionally balanced nor high in protein, are seldom used during breeding life-history events of waterbirds (Ringleman 1990). Irrigated alfalfa provides a high nutrient diet for a variety of species that inhabit the Upper Snake area and must contend with a radically changed landscape, one where natural wetlands and riparian habitats have been largely replaced by various agricultural crops. Agricultural habitats provide a surrogate habitat for a wide range of species. Alfalfa supports some of the highest biodiversity amongst row crops, with many species using alfalfa to forage, nest, rest, and hide (Hartman and Kyle 2010). Several bird species such as the white-Faced ibis, long-billed curlew, and Swainson's hawk are highly dependent on alfalfa to support them given a lack of native wetland and grassland habitat (Hartman and Kyle 2010).

As a legume, alfalfa may be particularly good habitat for earthworms, an important food source for many birds. Alfalfa contributes nitrogen to the soil, and high nitrogen promotes earthworm growth (Evans 1948) and increases their protein content (Stribling and Doerr 1985). More abundant and protein-rich earthworms is one hypothesis for preferential use of alfalfa over other irrigated crops by some waterbirds (Bray and Klebenow 1988). Irrigated fields, and in particular alfalfa, can be valuable feeding sites for white-faced ibis. Ryder and Manry (1994) argue that increased planting of alfalfa is a major reason for an increase in white-faced ibis populations in the West. Bray and Klebenow (1988) propose that where historical white-faced ibis feeding habitats have been diminished, flood irrigated crops could be maintained or even created to benefit ibis, and that the predominant crop should be alfalfa.

Alfalfa often supports an abundant small mammal community that is exploited by various birds of prey. Swainson’s hawks will hunt for mice and voles in alfalfa which provides a long-term, stable habitat for prey and good hunting conditions year round (Estep 1989). The optimal time for Swainson’s hawks to use alfalfa is when prey is easily accessible, especially after a cutting or irrigation and when field vegetation is less than 15 inches tall (Swolgaard et al. 2008). Swainson’s hawks rely heavily on the current agriculture landscape in southeast Idaho to provide adequate hunting grounds and safe nesting sites along riparian corridors. However, frequent early alfalfa cutting changes the amount and structure of vegetation used by many birds for nesting and also destroys nests and eggs of ground nesting birds (CPIF 2000; Frawley and Best 1991). Because of this the Refuge should limit alfalfa harvests to late summer and not consider or manage alfalfa as a particularly productive nesting habitat.

Effects of farming to refuge habitats: Cropland farming currently represents approximately 1.5 percent of Camas NWR (160 acres). Under proposed management, farmed acres would remain the same; however, should the Refuge lose its current cooperator, the acreage in dryland farming would increase. There could, therefore, be a minor negative impact on availability of grain for fall migrating geese and cranes under proposed management. However, proposed management would not impart any additional losses to native habitats from farming, since all proposed farm fields have already been in agricultural production.

Activities associated with crop production, including ground disturbance and field to field movement of cultivating and harvesting equipment, can disturb soils. Direct impacts of cropland management include exposure of soils to wind erosion and impacts from farm machinery. In general, tillage and cropping that leaves soil bare for portions of the year negatively affect soil quality indicators (Nelson et al. 2006) such as aggregate stability, infiltration rates, and available water capacity. Compaction can result from the use of farming equipment for seeding, causing undesirable increases in bulk density, while tilling may also prevent the accumulation of, or accelerate the decomposition of organic matter (USDA NRCS 2007).

By implementing a refuge conservation tillage system in the proposed management, the Refuge would improve soil retention, reduce fertilizer costs, and reduce erosion. As soil-conserving measures increase, wildlife habitat quality also improves (Lines and Perry 1978; Miranowski and Bender 1982). Among the benefits resulting from rotational practices proposed by the Refuge would be higher soil organic matter and nitrogen, lower fossil energy inputs, yields similar to those of conventional systems, and conservation of soil moisture and water resources, which is especially advantageous under drought conditions (Pimentel et al. 2005).

USEPA's guidance for estimating Particulate Matter (PM) emissions from agricultural crop tilling involves combining a constant emission factor with county-level activity data, including the silt content of surface soils, the number of tillings performed in a year for each crop type, and the acres of each crop type (USEPA 2001, 2004). It is estimated that the refuge contribution to PM emissions would be less under proposed management. While there would obviously be some continued impact to soil quality within proposed management, conservation tillage should impart a minor beneficial impact on soil, water, and air quality when compared to current management.

Cultivation and disturbance of soils fosters an undesirable opportunity for the introduction or spread of weeds on the Refuge. Invasive weed species have the potential to reduce habitat quality and forage opportunity and have been identified as one of the most serious threats to refuge habitats. To avoid the potential spread of invasive species onto the Refuge all equipment would be cleaned before entering the Refuge or being moved to different sites within the Refuge, and exotic grasses and weeds found in farm fields would be treated before they go to seed.

Farming may also result in the use and introduction into the environment of chemical agents from pesticide usage. In addition, small mammals, reptiles, and amphibians may be occasionally subject to mortality from farm machinery, and nesting birds may be occasionally disrupted and nests destroyed.

<u>Effects to listed species from farming:</u> Currently there are no listed species inhabiting the Refuge. Should agricultural farming management conflicts occur with listed species in the future, the Refuge would eliminate impacts to listed species or develop and implement minimization measures under Section 7 consultation of the Endangered Species Act. If deemed necessary, the cooperative farming program would be halted until all protective and minimizing measures can be evaluated and implemented as necessary.

<u>Effects to priority public uses from farming:</u> The agricultural fields targeted to provide forage for focal wildlife species indirectly support wildlife-dependent recreational activities such as wildlife observation and photography.

Haying

<u>Effects of haying to refuge wildlife:</u> The Refuge creates early successional short-stature habitats by haying wet meadows and upland meadows. These habitats provide easily accessible open foraging areas for several species that have proven highly adaptable to anthropogenic habitat alterations. Hayed refuge areas provide preferred short-cover habitat for wildlife such as greater sandhill cranes, long-billed curlew, and Canada geese (Eldred 2009; La Sorte and Boecklen 2005). Haying activities associated with the small refuge farming program also provide beneficial open foraging areas for elk, deer, and other resident wildlife.

The Refuge's current haying objectives are designed to provide limited areas of short statured habitat to increase wildlife foraging opportunities. Potential wildlife benefits frequently cited for providing managed short-cover grassland include: increased palatability of grasses for grazers, increased invertebrate forage availability and detection rates, reduced physical obstruction, and increased security from predators during grazing or foraging activity (Devereux et al. 2006).

Hayed or naturally occurring short-cover habitats are composed of low density herbaceous grass and forbs of 0-4 inches in height with bare ground, or light vegetative litter, easily visible. Ground foraging birds can easily move through this type of habitat and tend to select short cover habitat over dense grass habitat. Wildlife which select short-cover habitat include species that forage for invertebrates in meadows (e.g., greater sandhill crane, long-billed curlew, Canada goose, western meadowlark, American robin, cattle egret; grazing waterfowl (e.g., American widgeon, American coot, gadwall, Canada geese); and upland nesting birds (e.g., long-billed curlew, black-necked stilt, killdeer).

Dense cover habitat on the Refuge is defined as taller native or non-native unhayed herbaceous cover, at least 10-12 inches in height, dense enough to effectively conceal a passerine, shorebird, or duck nest from overhead or lateral view. Birds selecting dense cover for foraging and nesting include upland-nesting waterfowl (i.e., northern pintail, mallard, cinnamon teal, northern shoveler, gadwall); the meadow-nesting shorebirds (i.e., Wilsons' phalarope, willet, common snipe); secretive marsh birds (i.e., American bittern, Virginia rail, sora rail); and the shallow overwater nesting birds (i.e., black tern, marsh wren, red-winged blackbird, yellow-headed blackbird, northern harrier).

Current and proposed haying would reduce the height of the meadow grasses to the benefit of birds that prefer short grass pastures as a foraging habitat (Devereux et al. 2004; Perkins et al. 2000; Whitehead et al. 1995). Several mechanisms may underpin this choice including greater visibility for monitoring predators and conspecifics, improved prey accessibility and better mobility for foragers (Butler and Gillings 2004; Whittingham and Evans 2004; Whittingham and Markland 2002; Wilson et al. 2005). Conventional wisdom in agricultural and range management is that removal of "excess" or "decadent" plant litter increases sunlight and solar radiation, thereby warming soils earlier and promoting more available succulent plant growth earlier in the spring than areas covered by dense litter (Lecain et al. 2000). In Northern California, the abundance and diversity of birds, particularly sandhill cranes, on hayed meadow were equal to or greater than the abundance and diversity of birds on nonhayed plots (Epperson et al. 1999). However, Epperson and colleagues (1999) noted that cranes spent more time foraging and less time alert in hayed plots and concluded that foraging and vigilance by cranes to be more efficient in hayed meadows.

A second explanation of the preference of newly cut grass is that haying changes invertebrate activity or availability, for example by causing a temporary flush of prey (Vickery et al. 2001). The advantage to foraging in an area where prey is concentrated by mowing is intuitive (Cattin et al. 2003; Dunwiddie 1991), but it is less obvious why mowing could influence soil invertebrates. It is possible that the action of mowing changes the activity rates of soil-dwelling prey because of noise and vibration, especially when large machinery is used. Prey may respond to the disturbance by changing their activity rates in some way that translates into an increase in capture efficiency for short-cover foragers.

Insects form particularly valuable protein rich forage bases within wet meadows (Fredrickson and Reid 1988; Wissinger 1999). Mowing or haying may affect the meadows associated invertebrate community (Morris 1990; Purvis and Curry 1981). If a meadow is hayed annually, the timing of the cut would affect the invertebrates present. The later the cut, the more time invertebrates would have to complete their life cycle. Many insect larvae develop in the seedheads of grasses and flowering plants. For example, cutting in June would have the greatest effect on planthoppers (Delphacidae) and many fly species, whilst cutting in July/August would adversely affect leafhoppers (Cicadellidae). Intake efficiency of foraging passerine birds was found to be greater in recently hayed units (Devereux et al. 2006). Both intake rate and foraging efficiency are important determinants of a small bird's survival. Devereux and colleagues' (2006) results showed that although no more prey were captured on newly mown/hayed grasslands, energy expenditure was reduced because fewer searches were required for each prey captured.

In summary, there is good evidence that food abundance is the main driver in determining bird usage of fields for both invertebrate-feeders (Brickle et al. 2000), and seed-eaters (Moorcroft et al. 2002; Robinson and Sutherland 1999). However, food availability (i.e., abundance modified by ease of access to that food) has also been shown to be an important factor in determining bird usage (Henderson and Evans 2000; Henderson et al. 2001). Management for short structure, and the abundance and availability of food resources to birds, are inextricably linked (McCracken and Tallowin 2004).

While increased access to invertebrates is the principal advantage cited for short-cover management practices (Schekkerman and Beintema 2007), a negative effect of haying operations is a reduction in detritus that sustains much of the biomass and structure of the community (van der Valk 1989). Invertebrate production may be impeded because of unfavorable conditions associated with hydrology, substrate, and nutrient availability in scant or heavy litter accumulations (Magee 1993). However, with the small percentage of both the Refuge (1.5 percent annually) and comparative large acreage of unhayed wet meadow habitat on the Refuge (1,958 acres), this is a minor negative effect that is counterbalanced by enhanced foraging opportunities for species that prefer short cover.

Continuation of the Refuge’s haying program, with alterations of timing of haying as needed, would provide both short-stature habitat for meadow foraging and grazing birds and upland nesting birds, and taller, denser habitat for upland nesting waterfowl, secretive marsh birds, and shallow overwater nesting birds. Objectives as outlined in refuge proposed management integrate an understanding of the factors that determine why birds forage in particular fields as well as how the major management practices can be modified to produce habitats that are suitable not only for species who readily adapt to anthropogenic changes in habitat, but a diverse suite of species.

Haying involves the use of farm equipment to mow, rake, bale, and transport hay in grassland areas. The greatest potential for disturbance to wildlife occurs during mowing. Disturbance varies with vegetation composition and density, habitat use, wildlife species distribution and density, and time of year. Birds, mammals, amphibians, and reptiles may be temporarily or permanently displaced, injured, or killed. Collectively, several studies show a direct and often substantial impact of the harvesting process on the fauna, especially from the mowing stages, and that this impact depends on the techniques and equipment used, as well as the equipment settings, and the habitat and ecology of each species (Humbert et al. 2009). In Oregon, private hay fields appear to support more than 5,000 breeding shorebirds (inferred by Paullin et al. 1977). These authors stated that young shorebirds were especially vulnerable to mortality from hay cutting. In early July (July 1 and 13) hay mowing was documented to have killed the following: Wilson’s phalaropes; long-billed curlews; soras, common snipe, and blackbirds. They further found that, unlike ducks, shorebirds, especially Wilson’s phalarope, tend to remain in hay meadows to feed after hatching. Consequently, earlier nesting species may be directly vulnerable to mowing. An added indirect effect to fledging shorebirds is that dewatering actions within current management may concentrate young birds near limited food resources in remaining water, increasing their vulnerability to not only mortality from haying equipment, but to predators. Several studies suggest that early hay mowing mortality is greatest in the first two weeks of July (Braun et al. 1978; Dale et al. 1997; Labisky 1957; Sargeant and Raveling 1992).

Current management delays hay operators from initiating mowing or harvest of refuge hay until July 15; however, under proposed management haying may be further delayed (to between August 1 and August 15 depending upon habitat conditions that year) to ensure cutting occurs after the nesting season for grassland species is complete. Multiple researchers and management plans support the actions to minimize wildlife mortality from seasonal hay mowing by not allowing haying operations any earlier then August 1 (Bollinger et al. 1990; Dechant 2003; Krapu et al. 2000; Licht 1997; Perlut et al. 2006; USDA NRCS 2007; Warner and Etter 1989) and for assessing feasibility in proposed management for delaying haying operations further into mid-late August. Recommendations from managers of some grassland management areas indicate that waiting until mid-July for mowing or haying operations is adequate, however, waiting until mid-August would help prevent impacts to double and triple-brooded species that occur at Camas NWR such as savannah sparrows and meadowlarks (Warren and Anderson 2005). Because of the late mowing date it is expected that mowing would affect less than 10 percent of the ground nesting birds nesting within the hayed area.

<u>Effects of haying to refuge habitats:</u> Habitat fragmentation from human land-uses, such as haying, tends to increase the amount of edge adjacent to uplands (Laurance and Yensen 1991), thus subjecting upland wildlife populations to new or increased ecological interactions (e.g., predation, parasitism) associated with these edges (Wilcove et al. 1986). The prevailing principle of wildlife management is that increased edge and fragmentation of habitat negatively affect numerous species of nesting birds by increasing depredation or parasitism rates of nests (Paton 1994). Several specific studies report elevated rates of nest predation in fragmented forested and wetland landscapes (Donovan et al. 1997; Hartley and Hunter 1998; Robinson et al. 1995) and in small habitat remnants (Small and Hunter 1988; Wilcove 1985).

In a Canadian prairie wetland study, daily survival rate of upland nesting birds was highest in dense nesting cover and fields hayed late in the season, while idle pasture (hayed the previous year) and rights-of-way exhibited similar but lower nest success (Pasitschiniak-Arts and Messier 1995). These researchers also found nest survival was higher in spring than in summer for one of three years studied. In all years and habitats, significantly, more mammals than birds depredated waterfowl nests. In all years and habitats, significantly more mammals than birds depredated waterfowl nests. The relative importance of the two classes of predators was similar among delayed hay, dense nesting cover and rights-of-ways, but differed from idle pasture (hayed the previous year) where avian predation was higher (Pasitschiniak-Arts and Messier 1995).

Pacha and Petit (2008) studied the overall changes in vegetation and landscape structure changes due to management practices over two decades in Great Britain and the effects of fragmentation on a particular species. Their results indicated that there can be a general impoverishment in upland meadow vegetation from un-relinquished agricultural haying, with decreases in diversity, species richness and habitat quality leading to upland meadows becoming ten times more isolated than 20 years ago. While hayed areas on the Refuge do create edge habitat, the amount of haying on the Refuge (150 acres annually) would not change from current to proposed management. In addition the hayed area is limited (1.5 percent of the Refuge) and is grouped into a relatively small area, rather than dispersed throughout the Refuge. This limits both habitat fragmentation and edge habitat that could lead to increased predation.

Haying operations in wet soil types are noted to cause greater impacts to soil compaction and vegetation damage than on drier upland sites (Gilley et al. 1996). Gilley et al. (1996) further documented that soil roughness was significantly greater and bulk density significantly less on undisturbed long-term idle sites than hayed areas. The relatively large bulk densities measured on the hay fields imply that considerable compaction occurs at or near the soil surface from those operations (Murphy et al. 2004). Recent trends for increased size and use of tractors and agricultural machinery has additionally increased the probability of soil compaction during farm operations (Martel and MacKenzie 1980). Soil compaction by machinery has an indirect effect on soil invertebrates. Some earthworms can burrow into compacted soil (Joschko et al. 1989) but others have their activity restricted by compaction under conditions of high water (Kretzschmar 1991). Soil compaction has also been shown to decrease slug populations (Ferguson et al. 1988). Rabotnov (1974) found a decrease in proportion of soil geophytic grass in Russia, which could be partially explained by soil compaction as a result of hay collection.

Haying occurs on the Refuge from mid-July through August 31, in some of the driest months of the year. To further minimize soil compaction or damage in proposed management, fields that have been saturated by rain would not be hayed until soil conditions can support the required haying equipment. Since haying only occur in a drier time of the year and would not be allowed in areas of saturated soils, impacts from soil compaction would be minimal (Murphy et al. 2004).

There is also a potential for introduction of invasive plant species onto the Refuge from private equipment used in haying. To avoid the potential spread of invasive species onto the Refuge all equipment must be cleaned before entering the Refuge or being moved to different areas of the Refuge.

<u>Effects to listed species from haying:</u> Currently there are no listed species inhabiting the Refuge. Should hay management conflicts occur with listed species in the future, the Refuge would eliminate impacts to listed species or develop and implement minimization measures under Section 7 consultation of the Endangered Species Act. If deemed necessary, the cooperative farming program would be halted until all protective and minimizing measures can be evaluated and implemented as necessary.

<u>Effects to priority public uses from haying:</u> By providing foraging habitat for waterfowl, sandhill cranes, white-tailed deer, elk, and other wildlife, hayed fields indirectly support wildlife-dependent recreational activities such as wildlife observation and photography.

Anticipated Cumulative Effects of Agricultural Uses (Farming and Haying):

<u>Genetically modified organisms:</u> The NWRS does not authorize refuges to use genetically modified organisms (GMO) for agricultural uses. However, GMO seeds could be in-use on surrounding private farm crops now or in the near future. Pollen blown on the wind or carried by pollinator species may be capable of transferring genetically engineered traits, such as herbicide resistance and pest resistance, to closely related wild plants on the Refuge. Genetically engineered plants with weedy wild relatives are of particular concern to the Refuge. If expressed in the genetic background of a weed species, a transgene could increase the fitness of the weed in nature (Stewart et al. 2000). Laboratory studies have shown non-target pollinator species may also be harmed by wind-blown pollen. Monarch butterfly larvae have been shown in both laboratory and field tests (Jesse and Obrycki 2000; Losey et al. 1999) to suffer growth and mortality effects after feeding on milkweed plants dusted by corn pollen that was genetically engineered to express a bacterial toxin.

<u>Pesticides:</u> The Refuge can select less toxic pesticides and standardize operational procedures to minimize the immediate and accumulative effect of pesticides in the environment. However, the Refuge has no control over surrounding land-use and agricultural practices, thereby increasing the risk of acute and chronic exposures to wildlife from herbicides. Acute exposure is a single exposure or multiple brief exposures occurring within a short time (e.g., 24 hours or less in humans). Chronic exposures are those that extend over the average lifetime or for a significant portion of the lifetime of the species (USFS 2005). Herbicides from the Refuge would result in a moderate to minor risk from acute chemical exposure. However, unquantified and increasing risks from acute and chronic

exposure may occur via the aggregate impacts from refuge herbicide applications when combined with private, county, and State herbicide applications in the Beaver-Camas watershed.

Public Review and Comment:

Public review and comments are being solicited in conjunction with release of this Draft CCP/EA (USFWS 2013) in order to comply with the National Environmental Policy Act and with Service policy.

Determination:

____Use is Not Compatible

_X__Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

Farming Use on Camas NWR:

- Cropland farming would be done under an approved Cropland Management Plan per agency policy.
- Annual cooperative farming agreements would be established with the cooperator per agency policy.
- The cooperative farmer is required to perform habitat maintenance work to sustain the field conditions for the benefit of wildlife. Work may include mechanical weed control and fertilization.
- The agreement does not imply or establish a use precedent. Future use of the area would be based on the most satisfactory use of the land for wildlife benefits, cooperator performance, habitat management needs, and administrative needs.
- All improvements made to the Refuge as a result of this Cooperative Land Management Agreement become the property of the United States.
- The Cooperator would be responsible to perform fence maintenance, crop planting and water management as detailed in annual work plans within each CLMA.
- The cooperative farmer would exercise care to prevent fire and would assume responsibility for fire, which may result from his/her operations.
- No refuge equipment would be provided for use by the cooperator.
- At the end of the permit period, cooperator is responsible for removing all equipment from refuge lands.
- The cooperator shall be responsible for repairing damage to refuge facilities or habitat beyond normal wear and tear resulting from his/her operation.
- Pest plants and weeds would be controlled by the Service in accordance with the Refuge's IPM program using methods such as crop rotation, mechanical treatment, biological controls, and approved pesticides.
- Insecticides, fungicides and other chemicals would not be permitted under this agreement. Fertilizers can be used by the Cooperator to fertilize crops.
- Pesticide use must be in compliance with the Service policy requirements for completing an approved Pesticide Use Proposal, and it must meet other State and Federal requirements.
- Cooperators would provide a record of herbicides used including chemical name, amount used, date, location, and how applied.

- Pesticide applicators must meet all State, Federal, and agency requirements.
- Diligence shall be exercised in the control of county-listed invasive weeds.
- Equipment of cooperating farmers would be cleaned prior to being moved onto the Refuge and between fields when working in areas with weed infestations
- No genetically modified crops are allowed.
- Monitoring of the cropland farming program would be performed by qualified refuge staff.

Haying Use on Camas NWR

- Haying would be done under an approved Cropland Management Plan per agency policy.
- Annual cooperative haying agreements would be established with the cooperator per agency policy.
- The Refuge would assess local hay values at least every three years, or more often if needed, to ensure CLMAs are being conducted at a fair market value.
- Haying activities would start on or after July 15 each year and be completed by August 31, including removal of baled hay.
- Haying shall occur after July 15 to minimize impacts to ground nesting birds.
- The permittee shall remove all equipment and materials from the Refuge by the end of the haying season.
- Haying cooperators would provide a written report and record of annual hay harvest to the Refuge.
- The agreement does not imply or establish a use precedent. Future use of the area would be based on the most satisfactory use of the land for wildlife benefits, cooperator performance, habitat management needs, and administrative needs.
- The cooperator shall be responsible for repairing damage to refuge facilities or habitat beyond normal wear and tear resulting from his/her operation.
- Monitoring of the haying program would be performed by qualified refuge staff, including surveys to determine if haying is adversely impacting ground nesting birds.

Justification:

The Refuge's agricultural program is designed to provide areas of high-energy carbohydrates and protein (winter wheat, barley, and legumes), and green forage grasses to meet the food energy needs of migrating waterfowl and cranes, and to reduce crop depredation in nearby agricultural fields.

The Refuge manages all habitats to provide a variety of foods that would benefit migratory waterfowl. Although native vegetation provides higher levels of protein, fiber, and water than most agricultural crops, crops can provide easily accessible high energy foods that are more readily digestible than native plants and can reduce foraging time required to meet caloric demands (Alisauskas and Ankney 1992; Baldassarre and Bolen 2006; Raveling 1979). Waterfowl are able to exploit a variety of habitats to meet their daily and seasonal food requirements, and the Refuge provides a diversity of food supplies (native and non-native) in relative proximity to each other. Many birds also prefer to forage and rest in areas with the good visibility that hayed acreage provides to better detect predators such as coyotes. Haying removes tall vegetation that would restrict visibility and helps control weeds. In addition, the Refuge's hay fields and agricultural fields provided for target wildlife species indirectly support wildlife-dependent recreational activities such as wildlife observation and photography.

While agricultural crops are typically not limiting within the regional landscape, agricultural fields where all grain is produced and retained for wildlife use are. Refuge cropland management would be essential for waterfowl management in future years, both to provide food for wildlife and reduce crop depredation in nearby agricultural lands.

Hayed meadows would continue to provide optimal open foraging areas for several wetland dependent wildlife species such as greater sandhill cranes, Canada geese, and white-faced ibis, while dense late-successional wet meadows would provide habitat for a diverse suite of waterfowl, waterbirds, and shorebirds during several key times in their annual life histories (Heitmeyer et al. 1989; Rollins 1981). By providing a mixture of short (hayed) and dense cover, and both native and non-native habitats, proposed management would help maintain the biological integrity, diversity, and environmental health of the Refuge. These factors in turn contribute to the enhancement, protection, conservation, and management of native wildlife populations and their habitats.

By conducting the agricultural program under the management practices and stipulations described above, management anticipates that wildlife would find abundant native and non-native food resources and resting places on the Refuge. Additionally, it is anticipated that the results of monitoring would prevent negative impacts to fish, wildlife, plants, and their habitats and that the agricultural program would contribute to achieving refuge purpose(s) and the mission of the National Wildlife Refuge System.

As a management tool, cooperative land management use is a beneficial refuge operation in meeting purposes of the Refuge as well as goals and objectives established in the CCP. The farming and haying activities within the cooperative land management program contribute to achieving refuge purposes and goals identified in the CCP, as well as the National Wildlife Refuge System mission, by providing valuable foraging areas for migrating waterfowl and sandhill cranes, and habitat for nesting, foraging, and brood rearing for a variety of migratory birds and resident wildlife. As a result, cooperative farming contributes to achieving refuge purpose(s); contributes to the mission of the NWRS; and helps maintain the biological integrity, diversity, and environmental health of the Refuge. Allowing the use as described above would not materially detract or interfere with the purposes for which the Refuge was established or the mission of the Refuge System.

Mandatory Re-Evaluation Date (provide month and year for "allowed" uses only):

____ Mandatory 15-year Re-evaluation date (for priority public uses)

2024 Mandatory 10-year Re-evaluation date (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision:

____Categorical Exclusion without Environmental Action Statement

____Categorical Exclusion and Environmental Action Statement

_X_ Environmental Assessment and Finding of No Significant Impact

____Environmental Impact Statement and Record of Decision

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Signatures for Compatibility Determination 6, Agricultural Practices on Camas National Wildlife Refuge:

Prepared by: ______________________________ ____________
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: ______________________________ ____________
(Signature) (Date)

Concurrence

Refuge Supervisor: ______________________________ ____________
(Signature) (Date)

Regional Chief,
National Wildlife
Refuge System: ______________________________ ____________
(Signature) (Date)

B.10 Draft Compatibility Determination for Dog Walking on Camas National Wildlife Refuge

RMIS Database Uses: Dog walking

Refuge Name: Camas National Wildlife Refuge (NWR)

Location: Jefferson County, Idaho

Date Established: 1937

Establishing and Acquisition Authorities:
- Executive Order 7720, signed October 8, 1937, dated October 8, 1937
- Migratory Bird Conservation Act of 1929, as amended (16 U.S.C. § 715 et seq.)
- National Wildlife Refuge System Administration Act (16 U.S.C. § 668dd et seq.)

Refuge Purpose(s):

- "… as a refuge and breeding ground for migratory birds and other wildlife." (Executive Order 7720, dated Oct. 8, 1937)
- "… for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. § 715d (Migratory Bird Conservation Act)
- "… conservation, management, and … restoration of the fish, wildlife, and plant resources and their habitats … for the benefit of present and future generations of Americans… " 16 U.S.C. § 668dd(a)(2) (National Wildlife Refuge System Administration Act)

National Wildlife Refuge System Mission:

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

Description of Use:

Existing Use:

Currently dog walking is allowed on the Refuge in accordance with hiking rules. Dog walking is permitted year round on the 6.3 mile auto tour route and 27 miles of gravel/dirt service roads. Dog walking is prohibited on the 0.5-mile birding trail. Dog walking is also permitted off roads from July 16 to February 28. Dog walking is permitted daily from ½ hour before sunrise to ½ hour after sunset. Pets must be on a leash or under close control by a responsible party. Dog walking on the Refuge currently is an occasional use, with the majority by visitors who are traveling Interstate 15 and stop to visit the Refuge to take a rest break. Casual observations indicate that most dogs brought to Refuge are kept on a leash or are under close control.

Proposed Use:

We propose to continue the current use, except that dogs must remain on roads, and would be required to be on a leash or electronic collar at all times. If the owner is using an electronic collar to control the dog, they must demonstrate that the collar is functioning properly and is effective in controlling the dog's actions when necessary. Feces must be removed from roads and disposed of properly. Restrictions on this activity would be clearly posted at the refuge entrance and informational kiosks, parking lots, and in the refuge brochure and website.

Dog walking would be monitored annually along with other refuge uses to ensure compliance, and compatibility with wildlife management and wildlife-dependent recreational activities. If monitoring indicates routine non-compliance or compatibility conflicts, the Service would evaluate the need for limiting or prohibiting dog walking. This CD would be revised in ten years or sooner to incorporate additional data and new information.

Availability of Resources:

Maintenance of refuge roads incurs costs, but costs are not directly related to dog walking. Roads are routinely maintained for vehicle activity and to repair holes made by burrowing wildlife. No additional expense for dog walkers is anticipated. Since dog walking would be restricted to the roads, the major portion of the funds needed to support this activity are in the form of salaries for maintaining the existing roads, monitoring public use and biological impacts, enforcing regulations, and exotic species control. New regulations would need to be posted on signs and refuge brochures; however, the cost for this would be shared by other uses. It is expected that some additional staff time would be required during the first few years of implementation to educate visitors about the new regulations. Thus the Refuge has sufficient staff and funding to allow the use.

Category and Itemization	One-time ($000)	Annual ($000/yr)
Administration and management:	$0	$1,000
Maintenance:	$0	$0
Monitoring: Biological monitoring if use increases	$0	$2,000
Offsetting revenues: TOTALS	$0 $0	$0 $3,000

Anticipated Impacts of Described Use:

The impacts of dog walking, as conducted on Camas NWR, have not been studied in detail. Dog walking has the potential of impacting shorebird, waterfowl, marsh bird, and other migratory bird populations feeding and resting near trails or roads during certain times of the year.

Impacts to Habitat:

Both hikers and dog walkers can cause structural damage to plants and increase soil compaction. The degree of surface compaction is dependent on topography, soil structure, and soil moisture (Whittaker 1978). Impacts of trampling on vegetation and soils commonly noted on trails (Dale and Weaver 1974; Liddle 1975) are unlikely to occur on the well-defined, gravel surfaces of roads. The Service repairs, operates, and patrols the Auto Tour Road. Maintenance activities include planting trees, shrubs, and tall vegetation at points along the roadside, herbicide spraying, road grading, and gravel replenishment, as needed. Although dog-walkers would be required to remain on the roads, some users may leave roads to provide drinking water for their dogs, or to observe and photograph wildlife. Plants may be trampled in the process and wildlife disturbed. Currently, there is little evidence of this user group leaving roads.

Impacts to Wildlife (Disturbance):

<u>Wildlife response to dog walking:</u> Among the proposed public uses of the Auto Tour Road and refuge service roads, a human with a dog would elicit the greatest stress reaction in wildlife. In the case of birds, the presence of dogs may, reduce bird diversity and abundance in woodlands (Banks and Bryant 2007) and staging areas (Burger 1986; Lafferty 2001a,b), flush incubating birds from nests (Yalden and Yalden 1990), disrupt breeding displays (Baydack 1986), disrupt foraging activity in shorebirds (Hoopes 1993), and disturb roosting activity in ducks (Keller 1991). Many of these authors indicated that dogs with people, dogs on-leash, or loose dogs provoked the most pronounced disturbance reactions from their study animals. However, the greatest stress reaction results from unanticipated disturbance. Animals show greater flight response to humans moving unpredictably than to humans following a distinct path (Gabrielsen and Smith 1995).

The effects of human disturbance can be reduced by restricting human activity to an established trail, having disturbance free food areas for wildlife, and requiring dogs to be on a short leash or electronic collar and therefore under the control of the owner at all times. Sime (1999) concluded that maintaining control of pets while in wildlife habitats reduces the potential of disturbance, injury, or mortality to wildlife. In a study comparing wildlife responses to human and dog use on and off trails, Miller et al. (2001) recommended prohibiting dogs or restricting use to trails to minimize disturbance and that natural land managers can implement spatial and behavioral restrictions in visitor management to reduce disturbance by such activities on wildlife. Korschgen and Dahlgren (1992) and Fox and Madsen (1997) state the importance of disturbance-free food reserves and areas as a management alternative to minimize human disturbances. Dog walkers would be restricted to roads that are sufficiently distant from wildlife habitat to prevent significant disturbance.

Despite thousands of years of domestication, dogs still maintain instincts to hunt and chase. Given the appropriate stimulus, those instincts can be triggered. Dogs that are unleashed or not under the control of their owners may disturb or potentially threaten the lives of some wildlife. In effect, off-leash dogs increase the radius of human recreational influence or disturbance beyond what it would be in the absence of a dog. Dog-walkers would be required to maintain physical control of their animal while on the Refuge, thereby reducing the potential and severity of these impacts to wildlife. Special competition or dog training events would not be allowed since dogs function as an extension of their owner, and group size has been found to increase wildlife response to disturbance (Geist et al. 2005; Sime 1999; Yosef 2000). Restrictions on this activity would be clearly posted at refuge entrances, parking lots, and in the refuge brochure and website.

The role of dogs in wildlife diseases is poorly understood. However, dogs host endo- and ecto-parasites and can contract diseases from, or transmit diseases to, wild animals. In addition, dog waste is known to transmit diseases that may threaten the health of some wildlife and other domesticated animals. Domestic dogs can potentially introduce various diseases and transport parasites into wildlife habitats and to humans (Overgaauw 2009; Sime 1999). Studies have also documented the health and aesthetic impacts of dog feces and the benefits of removal (CDC 1995; Forestry Commission 2004; LEES and Associates Landscape Architects 2004; MacPherson 2005). In order to minimize the risk of disease introduction and reduce user group conflicts, dog walkers would be required to pick up dog feces and dispose of them properly.

Potential conflicts between user groups: Dog walking has the potential to result in conflicts with persons engaged in priority public uses (wildlife observation and photography). Dog owners may remove their dogs from leashes when they are out of view from refuge personnel. Westgarth et al. (2010) found that negative interactions with dogs are reduced when they are leashed. Requiring dogs to be on a short leash or electronic collar, and law enforcement to increase compliance, should greatly reduce any potential conflicts between user groups and infractions related to this activity.

Overall impact to Camas NWR: The studies cited above show that dog walking can and does disturb wildlife. Based on the circumstances described in the scientific literature, it is reasonable to assume similar effects could occur on Camas NWR in most areas where dog walking is allowed. However, we anticipate the impacts of dog walkers would be small, as a result of restricting this use to roads, imposing a leash requirement, requiring removal of dog feces, and educating the public on the effects of recreation on wildlife and habitat.

Public Review and Comment:

Public review and comments are being solicited in conjunction with release of this Draft CCP/EA (USFWS 2013) in order to comply with the National Environmental Policy Act and with Service policy.

Determination:

____Use is Not Compatible

_X__Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

- Dog-walkers would be required to stay on designated roadways throughout the year. Dog walking is only allowed on the Auto Tour Route (year round), and 27 miles of service roads (year round).
- Use is restricted to daylight hours only.
- Certified assistance dogs are allowed on all public use areas.
- These regulations do not apply to dogs that are being used by waterfowl and upland game hunters to flush or retrieve game, in accordance with refuge hunting regulations.
- Dogs must be kept leashed or on an electronic collar at all times. Dog owners must be able to demonstrate close control of their dog at all times to minimize disturbances to wildlife, wildlife habitat and other visitors.

- Dog owners must ensure their dog causes no harm to wildlife, the Refuge, or disturbance to other visitors.
- Dog droppings would be collected and disposed of properly off the Refuge by the responsible party. If domestic animal waste becomes a problem, dog-walking would be reevaluated.
- Organized dog training or competition events are prohibited.
- Regulations would be available to the public through a refuge brochure.
- Directional, informational, and interpretive signs would be posted and maintained to help keep visitors on trails and help educate the public on minimizing wildlife and habitat disturbance.
- Use would be periodically evaluated for disturbance to wildlife, especially if use numbers increase.

Justification:

Although dog walking is not a wildlife-dependent public use of the Refuge, as defined by statute (16 U.S.C. 668dd et seq.) this occasional use of the refuge roads is expected to have negligible impacts to wildlife habitat when compared to the effects of other public uses (Klein 1993). Potential for wildlife and habitat disturbance is minimal given the indirect approach of this activity, the enforcement of the leash or electronic collar rule and removal of dog feces. Restricting the disturbance to established roads would increase the predictability of public use on the Refuge, allowing wildlife to habituate to non-threatening activities. Impacts of dog walking would be monitored and if they, or other impacts, are discovered, this compatibility determination would be reevaluated. Direct costs to administer existing levels of dog walking on refuge roads would be minor because costs would already be covered by the existing Complex budget for maintaining wildlife-dependent public uses.

It is anticipated that wildlife populations would find sufficient food resources and resting places such that their abundance and use of the Refuge would not be measurably lessened from allowing dog walking on refuge roads. The relatively limited number of individuals expected to be adversely affected due to dog walking would not cause wildlife populations to materially decline, the physiological condition and production of wildlife species would not be impaired, their behavior and normal activity patterns would not be altered dramatically, and their overall welfare would not be negatively impacted. Thus, allowing dog walking to occur with stipulations would not materially detract or interfere with the purposes for which the Refuge was established or the Refuge System mission.

Mandatory Re-Evaluation Date (provide month and year for “allowed” uses only):

____ Mandatory 15-year Re-evaluation date (for priority public uses)

2024 Mandatory 10-year Re-evaluation date (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision:

____Categorical Exclusion without Environmental Action Statement

____Categorical Exclusion and Environmental Action Statement

_X_Environmental Assessment and Finding of No Significant Impact

____Environmental Impact Statement and Record of Decision

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Signatures for Compatibility Determination 7, Dog Walking on Camas National Wildlife Refuge:

Prepared by: ______________________________ ____________
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: ______________________________ ____________
(Signature) (Date)

Concurrence

Refuge Supervisor: ______________________________ ____________
(Signature) (Date)

Regional Chief,
National Wildlife
Refuge System: ______________________________ ____________
(Signature) (Date)

B.11 Draft Compatibility Determination for Bicycling, Jogging, Cross-Country Skiing, and Snowshoeing on Camas National Wildlife Refuge

RMIS Database Uses: Bicycling, Jogging, Cross-Country Skiing, Snowshoeing

Refuge Name: Camas National Wildlife Refuge (NWR)

Location: Jefferson County, Idaho

Date Established: 1937

Establishing and Acquisition Authorities:
- Executive Order 7720, signed October 8, 1937, dated October 8, 1937
- Migratory Bird Conservation Act of 1929, as amended (16 U.S.C. § 715 et seq.)
- National Wildlife Refuge System Administration Act (16 U.S.C. § 668dd et seq.)

Refuge Purpose(s):

- "… as a refuge and breeding ground for migratory birds and other wildlife." (Executive Order 7720, dated Oct. 8, 1937)
- "… for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. § 715d (Migratory Bird Conservation Act)
- "… conservation, management, and … restoration of the fish, wildlife, and plant resources and their habitats … for the benefit of present and future generations of Americans… " 16 U.S.C. § 668dd(a)(2) (National Wildlife Refuge System Administration Act)

National Wildlife Refuge System Mission:

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

Description of Use:

Existing Use:

The following non-consumptive, non-wildlife-dependent public uses are currently allowed on the Refuge: hiking, biking, jogging, snowshoeing, and cross-country skiing. These activities are allowed year round as road and weather conditions permit. However, jogging is not specifically addressed in the refuge brochure. These activities are allowed on improved (graveled) refuge roads: year round on the 6.3 mile Auto Tour Route and 27 miles of dirt and gravel service roads, and during the hunt season on 6.5 miles of roads leading to and within the waterfowl and upland game hunting areas. The Refuge does not maintain the roads specifically for these uses, and reserves the right to close any road to these uses because of disturbance to wildlife. Off-road hiking, cross-country skiing, and snowshoeing is allowed throughout the Refuge from July 15-February 28 as conditions permit. Bicycling is limited to improved roads. These activities are not allowed on the 0.5-mile pedestrian birding trail; however, this is not specifically addressed in the refuge brochure. Staff observations indicate that these uses are minor on the Refuge, with biking being the largest use, particularly in the spring and early summer. Jogging and bicycling do not occur in the winter months due to snow and ice conditions. The auto tour route, parking lots/pullouts, and service roads are open daily from ½ hour before sunrise to ½ hour after sunset throughout the year. Any refuge public use programs or activities that may require access after sunset or before sunrise would be managed by the refuge staff and may require Special Use Permits.

Proposed Use:

The Refuge would continue to allow the uses as described above, except that these uses would not be allowed off roads or on the pedestrian birding trail. These uses would continue to be allowed on improved (graveled) refuge roads as follows: on the 6.3 mile Auto Tour Route and 27 miles of dirt and gravel service roads year-round; on 6.5 miles of roads leading to and within the waterfowl and upland game hunting areas during hunting seasons. Regulations would be clearly posted on refuge signs and included in refuge brochures. Signs and brochures would list bicycling, jogging, cross-country skiing, and snowshoeing as approved activities, but limited to improved roads only. Signs prohibiting these activities on the pedestrian birding trail would be posted. Large groups of joggers, bicyclists, or cross-country skiers (more than ten in a group) or organized running, bicycling, or skiing events would not be allowed unless a Special Use Permit was obtained.

Availability of Resources:

Maintenance of refuge roads and trails incurs costs, but costs are not directly related to bicycling, jogging, cross-country skiing, and snowshoeing. Roads and trails would not be groomed specifically for skiing and snowshoeing. Roads are routinely maintained for vehicle activity and to repair holes made by burrowing wildlife. No additional expense for these activities is anticipated. Since these activities would be restricted to the roads and trails, the major portion of the funds needed to support this activity are in the form of salaries for maintaining the existing roads and trails, monitoring public use and biological impacts, enforcing regulations, and exotic species control. Thus the Refuge has sufficient staff and funding to allow the use.

Category and Itemization	One-time ($000)	Annual ($000/yr)
Updating refuge brochures		
Posting updated compliance signs		
Administration and management:	$0	$2,000
Maintenance: Posting signs and removing snow from entrance road	$0	$2,000
Monitoring: Biological monitoring if use increases	$0	$5,000
Offsetting revenues: TOTALS	$0 $0	$0 $9,000

Anticipated Impacts of the Use(s):

Impacts resulting from the proposed use include both direct and indirect impacts to wildlife resources and the associated habitat. Direct impacts have an immediate effect on wildlife and generally result from the public's interaction with wildlife. Indirect impacts would include actions taken by the public that would impact habitat or reduce access to habitat.

Effects to Habitat:

The primary impact visitors engaged in hiking, jogging, bicycling, cross-country skiing, and snowshoeing have on habitat is the trampling of vegetation and creation of social trails. Impacts to soil and vegetation caused by cross-country skiing and snowshoeing would be minimal, given the presence of snow cover and the fact that plants are dormant at this time. The primary impacts would be associated with jogging and bicycling.

Trail widening and creation of social trails increases the area of disturbed land (Adkison and Jackson 1996; Dale and Weaver 1974; Liddle 1975). Pedestrians can potentially cause structural damage to plants and increase soil compaction and erosion (DeLuca et al. 1998; Whittaker 1978). These impacts are unlikely to occur on the well-defined, gravel surface of refuge trails; however, social trails associated with off-trail use remains an issue for refuge managers as plants are trampled and wildlife is disturbed. Control of invasive plant species on the Refuge is a difficult and never-ending battle. Roads and trails often function as conduits for movement of plant species, including non-native, invasive species (Benninger-Truax et al. 1992; Hansen and Clevenger 2005). Propagules of non-native plants can be transported into new areas on hikers' boots, clothing, and equipment (Benninger-Traux et al. 1992). Once established, invasive plants can out-compete native plants, thereby altering habitats and indirectly impacting wildlife. Invasive plants and animals would be controlled and monitored as part of the Refuge's Integrated Pest Management Plan.

Effects to Wildlife:

Anticipated direct impacts include disturbance to wildlife by human presence which typically results in a temporary displacement of individuals or groups. Immediate responses by wildlife to recreational activity can range from behavioral changes including nest abandonment, altered nest placement, change in food habits, physiological changes such as elevated heart rates and increased energetic costs due to flight or flushing, or even death (Belanger and Bedard 1990; Knight and Cole 1995; Knight and Swaddle 2007; Miller et al. 1998; Miller and Hobbs 2000; Morton et al. 1989; Smith-Castro and Rodewald 2010). The long-term effects are more difficult to assess but may include altered behavior, vigor, productivity or death of individuals; altered population abundance, distribution, or demographics; and altered community species composition and interactions.

According to Knight and Cole (1991), there are three wildlife responses to human disturbance: 1) avoidance; 2) habituation; and 3) attraction. The magnitude of the avoidance response may depend on a number of factors including the type, distance, movement pattern, speed, and duration of the disturbance, as well as the time of day, time of year, weather; and the animal's access to food and cover, energy demands, and reproductive status (Fernández-Juricic 2007; Gabrielsen and Smith 1995; Knight and Cole 1991).

Habituation is defined as a form of learning in which individuals stop responding to stimuli that carry no reinforcing consequences for the individuals that are exposed to them (Alcock 1993). A key factor for predicting how wildlife would respond to disturbance is predictability. Often, when a use is predictable—following a trail or boardwalk or at a viewing deck—wildlife would habituate to and accept human presence (Oberbillig 2000). Gabrielsen and Smith (1995) suggest that most animals seem to have a greater defense response to humans moving unpredictably in the terrain (e.g., off-trail hikers) than to humans following a distinct path.

Direct impacts: Negative impacts to wildlife have been documented when migratory birds and humans are present in the same areas (Boyle and Samson 1985). Response of birds to human activities includes departure from site (Burger 1981; Henson and Grant 1991; Klein 1993; Korschgen et al. 1985; Owens 1977; Taylor and Knight 2003), use of suboptimal habitat (Erwin 1980; Williams and Forbes 1980), altered behavior (Burger 1981; Havera et al. 1992; Klein 1993; Korschgen et al. 1985; Morton et al. 1989; Ward and Stehn 1989), and increase in energy expenditure (Belanger and Bedard 1990; Morton et al. 1989). McNeil et al. (1992) found that many waterfowl species avoid disturbance by feeding at night instead of during the day.

The location of recreational activities impacts species in different ways. Miller et al. (1998) found that nesting success was lower near recreational trails, where human activity was common, than at greater distances from the trails. Stolen (2003) found that the proximity of wading birds to a roadway influenced the probability that a given bird would flush. Migratory waterfowl at J.N. "Ding" Darling NWR remained more than 80 m (262 feet) from the auto tour route, even when human visitation was low (Klein 1995).

Wildlife species also vary in their sensitivity to disturbance. Klein (1989) found that migratory dabbling ducks to be the most sensitive to disturbance, and that migrant ducks were more sensitive when they first arrived, in the late fall, than later in winter. She also found gulls and sandpipers to be apparently insensitive to human disturbance, with Burger (1981) finding the same to be true for various gull species. However, while gulls are relatively insensitive to disturbance while foraging away from breeding colonies, they can be extremely sensitive to human disturbance at nesting sites. Guay (1968) found that Franklin's gulls are particularly sensitive to human disturbance early in the breeding cycle and again during the chick phase, and would abandon with excessive human exposure. Likewise, Burger (1981) found that wading birds were extremely sensitive to disturbance in the northeastern United States. Disturbance during critical times in the breeding cycle may cause colony abandonment in colonial-nesting waterbirds. White-faced ibis are susceptible to colony abandonment resulting from human intrusion into colonies during the early nesting period (Ryder and Manry 1994). Abandonment of nests is less likely with young than eggs but may still occur with repeated disturbance (Burger and Gochfeld 1994).

Gutzwiller et al. (1997) found that singing behavior of some songbirds was altered by low levels of human intrusion. Resident waterbirds that are regularly exposed to human disturbance tend to be less sensitive than migrants, especially when migrants first arrive at a site (Klein 1993). In areas where human activity is common, birds tolerated closer approaches than in areas receiving less activity. Knight and Cole (1991) also suggested that sound may elicit a much milder response from wildlife if animals are visually buffered from the disturbance.

Pedestrian travel can impact normal behavioral activities, including feeding, reproductive, and social behavior. Studies have shown that ducks and shorebirds are sensitive to pedestrian activity (Burger 1981, 1986). A number of species have shown greater reactions when pedestrian use occurred off trail (Miller et al. 1998; Taylor and Knight 2003). Wildlife photographers tend to have larger disturbance impacts than those viewing wildlife since they tend to approach animals more closely (Klein 1993; Morton 1995).

Burger (1999 as cited by Oberbillig 2000) suggests that viewing distances that minimize disturbance can serve as useful guides for managers lacking good site-specific information and serve as a starting point in determining what is appropriate elsewhere. Some factors that affect viewing distances include the numbers of viewers, the time of day, and noise level. When exposing nonbreeding waterbirds to four types of human disturbances (walking, all-terrain vehicle, automobile, and boat), Rodgers and Smith (1997) concluded that a buffer zone of 100 m (328 feet) would minimize disturbance to most species of waterbirds.

<u>Wildlife response to bicycling and jogging:</u> Literature suggests that rapid movement is more disturbing to wildlife than slower movement. Rapid movement directly toward wildlife frightens them, while movement away from or at an oblique angle to the animal is less disturbing (Knight and Cole 1995). Depending on the level of use and compliance to regulations restricting off-trail use, some impact to wildlife would be expected. Although biking and jogging have the potential to cause flushing of birds from breeding and foraging habitats, these activities are not anticipated to cause large disturbances to wildlife due to the small number of bicyclists and joggers using the Refuge, and restriction of these activities to roads.

<u>Wildlife response to cross-country skiing and snowshoeing:</u> In two different studies of winter recreation impacts to wildlife in Yellowstone National Park (YNP), Aune (1981) and Cassirer (1990) found that, except for coyotes, all wildlife species observed (mostly big game) reacted more quickly to an approaching skier than to a snowmobile, and the flight distance was generally greater from skiers. Bison were found to respond dramatically to skiers who were off established trails. All wildlife species studied, including bison, were wary of people on foot. Aune (1981) also observed that in YNP, elk were less likely to flee from snowmobiles or skiers late in the winter than they were earlier in the season. He suggested that this was likely due in part to habituation by elk to snowmobile traffic and in part to decreased vigor of elk later in the season combined with the increasing difficulty of flight through deep, crusted snow. Proximity of escape cover that breaks the line of sight between elk and the disturbance may reduce flight distances and consequently the amount of energy used in flight. Moving automobiles and trail bikes had little effect on elk resting in timber at distances of only 0.13 miles (Lyon and Ward 1982).

Ferguson and Keith (1982) researched the influence of cross-country ski trail development and skiing on elk and moose distribution in Elk Island National Park in Alberta, Canada. They found no indication that overwinter distribution of elk was altered by cross-country skiing activity. However, it did appear that elk moved away from ski trails, particularly those that were heavily used, during the ski season.

Aune (1981) also reported average elk flight distances of 53.5 m (175.5 feet) in response to skiers at Yellowstone National Park. In another study, elk began to move when skiers approached to within 15 m (50 feet) in an area heavily used by humans year round, and within 400 m (1,312 feet) in an area where human activity is much lower (Cassirer et al. 1992). Elk in YNP fled more frequently and over greater distances from skiers off established trails than from skiers on established trails (Aune 1981).

Rudd and Irwin (1985) investigated the movements of moose in response to cross-country skiing and found that the average distance nineteen moose moved away from people on snowshoes or skis was 16.6 yards, and the average distance at which moose were displaced was 80.7 yards. These activities are not anticipated to cause large disturbances to wildlife due to the small number of cross-country skiers and snowshoers using the Refuge, and restriction of these activities to roads.

<u>Potential conflicts between user groups:</u> Since users engaged in jogging and bicycling travel at a faster rate than hikers, and are more likely to disturb wildlife than walking or automobiles, there is the potential for these activities to result in conflicts between joggers and bicyclists, and user groups engaged in wildlife observation and photography. By flushing wildlife these activities could potentially reduce the quality of experience for visitors using the Auto Tour Route, photographing birds from portable blinds in designated areas, or hiking in designated areas. However jogging and bicycling currently occur only infrequently on the Refuge and therefore user group conflicts are expected to be low. If the level of use increases and conflicts are documented, the use would be re-evaluated. Cross-country skiing and snowshoeing occur infrequently and when other visitor use is low and therefore conflicts with other user groups are unlikely. There is a potential for these activities to interfere with elk hunters; however allowing these uses only on roads within the elk hunting area would minimize these conflicts.

<u>Cumulative and indirect/secondary impacts:</u> Indirect impacts of wildlife-dependent activities depend on a number of variables, such as season of use, duration of activity, location and number of users. People can be vectors for invasive plants by moving seeds or other propagules from one area to another. Once established, invasive plants can out-compete native plants, thereby altering habitats and indirectly impacting wildlife. The threat of invasive plant establishment would always be an issue requiring annual monitoring and treatment when necessary. Refuge staff would work at eradicating invasive plants and educating the visiting public. Providing and maintaining access points to the Refuge indirectly impacts wildlife by creating barriers to movement, through vegetation removal and management, and abrupt edge creation that may lead to increased predation (Ratti and Reese 1988). Trail edges may concentrate prey species and may be used by predators as travel corridors.

Other indirect impacts may include trampling of vegetation, erosion, littering, removal of vegetation, and vandalism. These adverse impacts are expected to be short term and limited to locations along the auto tour route, roads, parking/pullouts, and associated facilities.

Despite the potential for the above effects to result from public visitation, the physical impacts, disturbance to wildlife and habitat, and disturbances on the Refuge are expected to be intermittent, minor, and short term, and in the context of the amount of the Refuge closed to these uses (sanctuary), allowing these uses on the Refuge is not expected to diminish the value of the Refuge for its stated purposes.

<u>Summary and application to Camas NWR:</u> The use of the auto tour route, roads, and associated facilities on the Refuge provides potential for human disturbance of wildlife. Since Camas provides important breeding habitat for migratory waterfowl and waterbirds, the primary concern on Camas NWR would be disturbance to wildlife (especially waterfowl and waterbirds) during the nesting and brood-rearing season, which coincides with the peak season for public use on the Refuge. In addition there are concerns regarding disturbance to waterfowl, waterbirds, and landbirds during migration, and to bald eagles at their winter roost in the cottonwoods near the refuge headquarters. A good way to control the impacts of non-consumptive wildlife-dependent uses is to mitigate the effect on wildlife by managing these uses in time and space. To minimize disturbance to wildlife, the Refuge would only be open from ½ hour before sunrise to a ½ hour after sunset. Bicycling, jogging, cross-country skiing, and snowshoeing would be allowed only on the 6.3-mile Auto Tour Route (year round), 27 miles of dirt and gravel service roads (year round), and 6.5 miles of additional roads leading to and within the waterfowl and upland game hunt units during the hunting season. The existing auto tour route and roads are located at a sufficient distance from important wildlife use

areas that minimal disturbance would occur. Off-road bicycling, jogging, cross-country skiing, and snowshoeing would be prohibited. Limited these activities to roads would limit the footprint of disturbance, and by increasing predictability, would allow wildlife to habituate to the use. To limit disturbance, refuge staff would limit the number and group size, and manage the timing and location of organized bicycling, jogging, cross-country skiing, and snowshoeing events by issuing special use permits.

Public Review and Comment:

Public review and comments are being solicited in conjunction with release of this Draft CCP/EA (USFWS 2013) in order to comply with the National Environmental Policy Act and with Service policy.

Determination:

____Use is Not Compatible

_X__Use is Compatible with Following Stipulations

Stipulations Necessary to Ensure Compatibility:

- Activities associated with this proposed use are restricted to those portions of the Refuge that are open to the general public during daylight hours.
- Visitors must adhere to seasonal use restrictions to reduce disturbance to nesting waterfowl and other wildlife.
- Bicycling, jogging, cross-country skiing, and snowshoeing are allowed only on the Auto Tour Route (year round), 27 miles of service roads (year round), and 6.5 miles of roads leading to and within the north and south waterfowl and upland game hunt unit during the hunt season.
- Pedestrian use only allowed on the birding trail. Bicycling, jogging, cross-country skiing, snowshoeing, and dog walking are prohibited.
- Camping, overnight use, and fires are prohibited.
- Littering is prohibited.
- Harassment of wildlife or excessive damage to vegetation is prohibited.
- Collection of plants and animals is prohibited unless a Special Use Permit is obtained from the Refuge (except wildlife captured while engaged in fishing and hunting).
- Activities requiring off road/trail access or access between ½ hour after sunset and ½ hour before sunrise would require a Special Use Permit or be managed by refuge staff.
- Organized bicycling, jogging, cross-country skiing, or snowshoeing events, and all such activities with a group size of more than ten, require a Special Use Permit.
- The Refuge would provide signs and brochures that clearly state pertinent refuge-specific regulations. Verbal instructions from refuge staff would promote appropriate use of refuge facilities to minimize wildlife and habitat disturbance.
- The Refuge would periodically monitor and evaluate sites and programs to determine if objectives are being met and the resource is not being degraded.

Justification:

Although bicycling, cross-country skiing, and snowshoeing are not wildlife-dependent public uses of the Refuge, as defined by statute (16 U.S.C. 668dd et seq.), these occasional uses of the refuge roads and trails are expected to have negligible impacts to wildlife habitat when compared to the effects of other public uses (Klein 1993). Potential for wildlife and habitat disturbance is minimal given the low level of these uses, and for cross-country skiing and snowshoeing, the time of year the use occurs. Restricting the disturbance to established roads would increase the predictability of public use on the Refuge, allowing wildlife to habituate to non-threatening activities. Impacts of these activities would be monitored and if they, or other impacts, are discovered, this compatibility determination would be reevaluated. Direct costs to administer existing levels of bicycling, jogging, cross-country skiing, and snowshoeing on refuge roads and trails would be minor because costs would already be covered by the existing Complex budget for maintaining wildlife-dependent public uses.

It is anticipated that wildlife populations would find sufficient food resources and resting places such that their abundance and use of the Refuge would not be measurably lessened from allowing bicycling, jogging, cross-country skiing, and snowshoeing on refuge roads. The relatively limited number of individuals expected to be adversely affected due to these activities would not cause wildlife populations to materially decline, the physiological condition and production of wildlife species would not be impaired, their behavior and normal activity patterns would not be altered dramatically, and their overall welfare would not be negatively impacted. Thus, allowing bicycling, snowshoeing, and cross-country skiing to occur with stipulations would not materially detract or interfere with the purposes for which the Refuge was established or the Refuge System mission.

Mandatory Re-Evaluation Date (provide month and year for “allowed” uses only):

____ Mandatory 15-year Re-evaluation date (for priority public uses)

2024 Mandatory 10-year Re-evaluation date (for all uses other than priority public uses)

NEPA Compliance for Refuge Use Decision:

____Categorical Exclusion without Environmental Action Statement

____Categorical Exclusion and Environmental Action Statement

_X_ Environmental Assessment and Finding of No Significant Impact

____Environmental Impact Statement and Record of Decision

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Signatures for Compatibility Determination 8, Bicycling, Jogging, Cross-Country Skiing, and Snowshoeing on Camas National Wildlife Refuge:

Prepared by: ____________________________________ ____________
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: ____________________________________ ____________
(Signature) (Date)

<u>Concurrence</u>

Refuge Supervisor: ____________________________________ ____________
(Signature) (Date)

Regional Chief,
National Wildlife
Refuge System: ____________________________________ ____________
(Signature) (Date)

Appendix C. Implementation

C.1 Overview

Implementation of the Preferred Alternative of the CCP will require increased funding, which will be sought from a variety of sources. Full implementation will depend on additional Congressional allocations, partnerships, and grants. There are no guarantees that additional Federal funds will be made available to implement any of these projects. Other sources of funds will need to be obtained (both public and private). Activities and projects identified in the Preferred Alternative would be implemented as funds become available.

Even though Camas NWR is a relatively small (10,578 acre) refuge, it has a fair amount of infrastructure, much of which was originally constructed by the WPA in the late 1930s to early 1940s. Five administrative buildings are at the headquarters site; three of these were built by the WPA and are in need of maintenance and energy efficiency upgrades. The Refuge also has two residential buildings, one of which is in need of updates as well. Almost 40 miles of roads, 50 water control structures, numerous miles of dikes and water delivery ditches, and nine irrigation wells exist on the Refuge. Of the nearly 40 miles of roads, 6.3 miles are maintained for year-round use as an auto-tour route and 6.5 miles are maintained for hunter access. Currently, a large backlog of maintenance needs exists on the Refuge. Additional staff and/or funding are needed to proactively address the current maintenance/repair backlog, and are included here in the analysis of funding needs.

The Preferred Alternative includes several projects to be implemented over the next fifteen years. Some of these projects are included in the Refuge Management Information System (RONS—Refuge Operational Needs System or SAMMS—Service Asset Maintenance Management System) which is used to request funding from Congress. Upon completion of the CCP, new projects that are needed to meet refuge goals and objectives and legal mandates would be entered into RONS documents or SAMMS databases.

Annual revenue sharing payments to Jefferson County would continue. If the Refuge undergoes a boundary expansion, additional in lieu of tax payments would be made to the county. See Draft CCP/EA Chapter 6 for a summary of the economic effects.

Inventory and monitoring would be conducted on new and existing projects to document changes to habitat conditions and responses to management practices over time. In Alternatives 2 and 3 the Refuge would change both its infrastructure and water management to adapt to the changes that have occurred to the water table in the surrounding area. These changes will be critical to the overall function of the Refuge in the future.

Step-Down Plans

The Comprehensive Conservation Plan is one of several plans necessary for refuge management. The CCP provides guidance in the form of goals, objectives, and strategies for several refuge program areas but may lack some of the specifics needed for implementation. Step-down management plans will be developed for individual program areas within approximately five years after CCP completion. All step-down plans require appropriate NEPA compliance; implementation may require additional permits. Step-down plans for the Refuge follow (Table C-1). Project-specific plans, with appropriate NEPA compliance, may be prepared outside of these step-down plans.

Table C-1. Step Down Plans

Step Down Management Plan	Status (Date Completed and/or Date to be Prepared/Updated)
IPM Plan	2013 (prepared concurrently with CCP, Appendix F)
Inventory and Monitoring Plan	CCP I&M goal (Chapter 2, Goal 4) serves as an interim I&M Plan (2013-2015). A full I&M step down plan will be developed in 2016.
Wetland and Riparian Rehabilitation Plan	2017
Habitat Management Plan	CCP habitat goals (Chapter 2, Goals 1-3) serves as interim HMP; a full HMP will be developed after completion of Wetland and Riparian Rehabilitation Plan.
Fire Management Plan (Revision)	2014. Current plan completed March 2009, included with CCP (Appendix G).
Cultural Resources Management Plan	2013 (Prepared concurrently with CCP, Appendix H.)
Visitor Services Plan	CCP Visitor Services goal (Chapter 2, Goal 5) serves as interim VSP. A full VSP for the SE Idaho Complex would be developed in 2015.
Outreach and Communications Plan	2015
Land Protection Planning	A Preliminary Project Proposal (PPP) would be developed within three years of CCP completion (2016). If the PPP by the USFWS Director is approved, a more detailed Land Protection Planning (LPP) process would then be initiated.
Hunt Plan	2013 (prepared concurrently with CCP, Appendix M)

C.2 Costs to Implement CCP

The following sections detail both one time and recurring costs for various projects, by alternative. Table C-2 lists the current and proposed staff needed to implement the CCP alternatives, and salaries (2011 dollars). Only permanent staff positions are included in this table. Table C-3 lists one time and recurring costs associated with implementing the CCP alternatives. One-time costs reflect the initial costs associated with a project, for instance, purchase of equipment, contracting services, construction, a research project, and so on. Recurring costs reflect the future operational and maintenance costs associated with the project. Table C-3 primarily documents projects with a physically visible, trackable, “on-the-ground” component, such as structures, habitat restoration, research, and inventory and monitoring. The scope and costs for “administrative” activities such as memoranda of understanding (MOUs), reporting, and establishment of partnerships are difficult to estimate in advance, and thus are not accounted for in the table.

Table C-2. Current and Proposed Staffing by Alternative (FY 2011 dollars)

Current Staff Positions	Series and Grade	Annual Salary Cost	Alt 1	Alt 2	Alt 3
Wildlife Refuge Manager	GS-0485-14	**35,956***	x	x	x
Wildlife Refuge Manager	GS-0485-13	**30,092***	x	x	x
Wildlife Refuge Manager	GS-0485-12	**100,100**	x	x	x
Wildlife Biologist	GS-0486-11	**45,782****	x	x	x
Administrative Officer	GS-0341-09	**19,375***	x	x	x
Budget Technician	GS-0341-05	**10,667***	x	x	x
Fire Management Officer	GS-0401-11	**26,037***	x	x	x
Park Ranger (LEO)	GL-0025-09	**23,879***	x	x	x
Engineering Equipment Operator	WG-5716-09	**76,500**	x	x	x
Total Annual Cost for Current Staff		**$368,388**			
Proposed Staff Positions in the Refuge Operational Needs System (RONS) + Project # and 2008 Ultimate Organizational Chart					
Park Ranger	GS-0025-5/7	$65,000		x	x
Complex Visitor Services Manager/Volunteer Coordinator	GS-0485-9/11	$25,000*		x	x
Engineering Equipment Operator	WG-5716-09	$76,500		x	x
Total Annual Cost for Proposed Staff		**$166,600**			
Grand Totals (Current and Proposed Staff)			**$368,388**	**$534,988**	**$534,988**

*Salary is ¼ of total as these positions are shared amongst four refuges within the SEI Complex
**Salary is ½ of the total as this biologist positions is shared between two refuges within the SEI Complex

GS/GL: General Schedule, Federal Employee, WG/WS: Wage Grade Scale, Federal Employee
Costs are based on FY 2011 Full-Time Equivalent (FTE) utilization plan for the Refuge and the Office of Personnel Management (OPM) General Schedule FY 2011 plus 40 percent benefits. For the proposed positions, the cost is the grade level at step one plus 40 percent for benefits.

Table C-2 illustrates an increase of 2.25 FTE staff positions over the current staffing level for Alternative 2 (Preferred Alternative) and Alternative 3. At the current staffing level, actions items are addressed based upon the most critical need.

The **Complex Visitor Services Manager/Volunteer Coordinator** position is needed to help the Southeast Idaho NWR Complex acquire and manage volunteers needed to accomplish both visitor services and wildlife and habitat goals and objectives (for example assisting with invasive species control, habitat restoration, or inventory and monitoring). The Complex Visitor Services Manager would also oversee and assist with the development of new or expanded visitor services programs at all four refuges in the SE Idaho Complex.

The **Park Ranger** position would allow Camas NWR to expand wildlife observation and photography, environmental education, interpretation, and hunting programs. This position would assist with the development of visitor services step down plans and new or updated visitor services, products, facilities, and programs on the Refuge. The Park Ranger would also conduct day to day management of visitor services programs, and of volunteers that assist with delivery of visitor services projects and programs.

The **Engineering Equipment Operator** position is needed to accomplish expanded habitat management and restoration activities proposed under Alternatives 2 and 3.

C.2.1 One-Time Costs

One-time costs shown in Table C-3 are project costs that have a startup cost associated with them, such as purchasing a new vehicle for wildlife and habitat monitoring or designing and installing an interpretive sign. Some are full project costs for those projects that can be completed in three years or less. One-time costs include salaries for temporary or term staff associated with a short-term project. Salaries for full-time staff stationed on the Refuge are reflected in recurring costs.

Funds for one-time costs would be sought through increases in refuge base funding, special project funds, and grants. One-time costs in Table C-3 include those associated with building and facility needs including offices, public use facilities, road improvements and new signs. One-time costs are also associated with projects such as habitat restoration, invasive plant and animal control, and research. New research projects, because of their short-term nature, are considered one-time projects and include costs taken from RONS and 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.

C.2.2 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.

Recurring costs are associated with aquatic and terrestrial habitat management, conservation activities, inventory and monitoring, and operating visitor services programs. Costs include salaries and operational expenditures such as fuel, supplies, materials, utilities, and maintenance of equipment and facilities. Recurring costs include salaries for permanent staff that are stationed on the Refuge and seasonal staff that are hired annually. Salaries for staff stationed at the Complex and shared by the refuges in the Complex are not included in recurring costs.

Table C-3 is also related to the Refuge Annual Performance Plan. The table does not project costs other than operational. These data are separated into two tables, Wildlife and Habitat and Public Use, and each is organized by goals.

Maintenance Costs: The maintenance need over the next fifteen years is defined as funds needed to repair or replace buildings, equipment, and facilities. Maintenance includes preventative maintenance: cyclic maintenance; repairs; replacement of parts, components, or items of equipment;

adjustments, lubrication, and cleaning (non-janitorial) of equipment; painting; resurfacing; rehabilitation: special safety inspections; and other actions that ensure continuing service and prevent breakdown. Maintenance costs include the maintenance "backlog"—maintenance needs that have come due but are as yet unfunded, as well as the increased maintenance need associated with new facilities, infrastructure needing updating or rehabilitation, and moving facilities and operations to a carbon neutral or negative status.

The facilities associated with the Refuge that require maintenance include trails, interpretive panels, regulatory signs, roads, water delivery system and structures. Major equipment includes: vehicles, heavy equipment, all-terrain vehicles (ATVs), and utility terrain vehicles (UTVs).

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Table C-3. Cost to implement the CCP, by alternative.

Objective	Program	Strategy	Project/ Methodology	Recurrence Interval (over 15 years)	Recurring Cost (incl salary, fuel, eqpt)	One-time Cost	Priority	Alt 1	Alt 2	Alt 3
Goal 1. Native Habitats										
1.1, 1.2, and 1.3	Wetland Habitat Management	Use groundwater pumping through 7 irrigation wells to help fill and maintain water in wetlands		Annual	$70,000/yr (Alt 1) $50,000/yr (Alt 2) $60,000/yr (Alt 3)		H	x	x	x
		Use surface water rights to fill wetlands from waters in Camas Creek		Annual	$10,000/yr		VH	x	x	x
		Use of prescribed fire to remove emergent cover on an average of about 100 acres of wetland per year		Annual (1 burn/yr)	$8,000/yr		M	x	x	x
		Use of mechanical manipulation to reduce emergent cover		Annual (1 wetland/yr)	$1,000/yr		M	x	x	x
		Maintain and repair water pumps, control structures and ditches		Annual	$1,500/yr		H	x	x	x
		Document all water flows and water level manipulations		Annual	$8,000/yr		H	x	x	x

Table C-3. Cost to implement the CCP, by alternative.

Objective	Program	Strategy	Project/ Methodology	Recurrence Interval (over 15 years)	Recurring Cost (incl salary, fuel, eqpt)	One-time Cost	Priority	Alt 1	Alt 2	Alt 3
		Use of IPM techniques to treat invasive species within wetland areas (mostly bio. control)		Every 5 years	\$2,000 × 3 (\$400/yr)		H	x	x	x
		Lowering of the banks of Camas Creek to increase occurrence of over-bank flooding		1		\$250,000	VH		x	x
		Design a new water delivery system to mimic natural flooding occurrence.		1		\$20,000	VH		x	x
	Hemi-Marsh I&M	Water level and vegetation monitoring (water levels annually, vegetation every 3 years)		Water levels: annual; vegetation: every 3 years	\$3,000/yr (water level monitoring)	\$5,000 × 5 (veg monitoring)	H		x	x
		Emergent and submergent aquatic vegetation studies.		2		10,000 × 2	H		x	x
	Hemi-Marsh Research	Management/admin costs for wetland habitat NIC above			A1: 72,173/yr A2: 92,000/yr A3:			x	x	x

Table C-3. Cost to implement the CCP, by alternative.

Objective	Program	Strategy	Project/ Methodology	Recurrence Interval (over 15 years)	Recurring Cost (incl salary, fuel, eqpt)	One-time Cost	Priority	Alt 1	Alt 2	Alt 3
					90,400/yr					
1.4	Camas Creek Riparian Habitat Management	Maintain one point of diversion along Camas Creek		For life of plan		$3,000	M	x		
	Camas Creek Riparian I&M	Monitor wildlife usage and vegetation.		1		$15,000	H		x	x
	Camas Creek Riparian Research	Study changes in vegetation due to changes in management schemes.		1		$15,000	H		x	x
		Management/admin costs for riparian/shelterbelt habitat NIC above			A1: 18,043/yr A2: 23,000/yr A3: 22,600/yr			x	x	x
1.5	Semi-Desert Shrub Steppe Habitat Management	Restore native grasses on average 50 acres per year to degraded uplands		1		$17,500	M		x	x
		Monitor plant diversity in sagebrush restoration sites		For life of plan		$3,000	M		x	x
		Mechanically treat sage-brush habitat that is		1		$2,000	L		x	x

Table C-3. Cost to implement the CCP, by alternative.

Objective	Program	Strategy	Project/ Methodology	Recurrence Interval (over 15 years)	Recurring Cost (incl salary, fuel, eqpt)	One-time Cost	Priority	Alt 1	Alt 2	Alt 3
		dominated by late seral stage sage								
		Use IPM techniques to treat invasive plants in upland habitats		Annual	$3,000/yr		H	x	x	x
	Semi-Desert Shrub Steppe I&M	Monitor vegetation every 5 years, small mammal and reptile surveys			$2,000 every 5 years ($400/yr)		M		x	x
	Semi-Desert Shrub Steppe Research	Research on sage-obligate bird species.		1		$10,000	M		x	x
		Management/admin costs for upland habitat NIC above			A1: 36,086/yr A2: 46,000/yr A3: 45,200/yr			x	x	x
	Annual Cost **One Time Cost** **Subtotal, Goal 1 (AC × 15 + OTC)**							228,202 3,000 **3,426,030**	246,300 377,500 **4,072,000**	253,500 377,500 **4,180,000**

Table C-3. Cost to implement the CCP, by alternative.

Objective	Program	Strategy	Project/ Methodology	Recurrence Interval (over 15 years)	Recurring Cost (incl salary, fuel, eqpt)	One-time Cost	Priority	Alt 1	Alt 2	Alt 3
Goal 2. Naturalized Habitats										
2.1	Shelterbelt Habitat Management	Use groundwater pumping to provide water to tree plantings		Annual	$2,000/yr		M	x		
		Re-design of water delivery system to tree plantings for more efficiency		Annual	$1,500/yr		M		x	x
		Develop micro-irrigation system with renewable solar power		1		$4,000	M		x	x
		Preparation of planting sites using a combination of manual, mechanical, prescribed fire and herbicide treatments		Every 5 yrs		$1,500 × 3	M		x	x
		Plant an additional 800 m^2 area of cottonwood saplings		1		$5,000	L		x	x
		Protect plantings from rodent and deer damage by planting small trees in protective plastic tubing, rodent and deer proof fencing and rodent repulsion chemicals.		1		$2,000	L	x	x	x

Table C-3. Cost to implement the CCP, by alternative.

Objective	Program	Strategy	Project/ Methodology	Recurrence Interval (over 15 years)	Recurring Cost (incl salary, fuel, eqpt)	One-time Cost	Priority	Alt 1	Alt 2	Alt 3
		Replace non-native and or invasive trees and shrubs with ones that are native to Idaho and provide similar habitat and food values		Every 3 yrs		$4,000 × 5	L		x	x
		Use of IPM strategies including mechanical, physical, biological and chemical means to control or contain invasive and undesirable plants		For life of plan		$3,000	M	x	x	x
	Shelterbelt Habitat I&M	Re-initiate landbird banding and monitoring station to inventory and monitor spring/fall migrants		1		$60,000	L		x	x
	Shelterbelt Habitat Research	Initiate landbird study of diet and feeding habits in Camas shelterbelt habitat		1		$40,000			x	x
	Annual Cost **One Time Cost** **Subtotal, Goal 2 (AC × 15 + OTC)**							2,000 5,000 **$35,000**	1,500 138,500 **161,000**	1,500 138,500 **161,000**

Table C-3. Cost to implement the CCP, by alternative.

Objective	Program	Strategy	Project/ Methodology	Recurrence Interval (over 15 years)	Recurring Cost (incl salary, fuel, eqpt)	One-time Cost	Priority	Alt 1	Alt 2	Alt 3
Goal 3. Agricultural Habitat										
3.1 and 3.2	Agricultural Crop Management	If cooperative farming should become cost prohibitive because of irrigation transition to dry land farming using refuge funds		Annual	Up to $4,000/yr depending on implementati on				x	
		Rehabilitate Well #9 field back to native sage-steppe habitat		20 acres every year for 4 years		$7,000 per year for 4 years = $28,000	L			x
		Annually survey and monitor wildlife use within agricultural fields		Annual	$500		M		x	x
		Apply lime to soil 6 months prior to actual planting dates		For life of plan	Completed by cooperator		L		x	x
		Mow grasses adjacent to alfalfa fields to maintain short vegetation along field		Annual	$1,000/yr		L		x	x

Table C-3. Cost to implement the CCP, by alternative.

Objective	Program	Strategy / Project/ Methodology	Recurrence Interval (over 15 years)	Recurring Cost (incl salary, fuel, eqpt)	One-time Cost	Priority	Alt 1	Alt 2	Alt 3
		Mow strips of small grain as the mature in late summer or early fall to provide forage base for migratory birds	Annual	$1,000/yr		L		x	x
		Apply herbicides on farmed units as necessary.	Annual	$1,000		M	x	x	x
3.3	Hay Meadow Management	Employ late summer prescribed fire to meadows if short cover objectives cannot be met	One meadow burn every 5 years	$8,000 x3 ($1,600/yr)		M		x	x
		Reseed hay meadows predominated by non-native grasses to more desirable mix	40 acres per year for the next 10 years	40 acres × $250 per acre × 10 years = $100,000 ($6,700/yr)		L		x	x
		Require cooperators to clean equipment before entering and upon leaving the Refuge (cost = refuge-supplied equipment)	1		$2,000 (eqpt cost)	H		x	x

Table C-3. Cost to implement the CCP, by alternative.

Objective	Program	Strategy	Project/ Methodology	Recurrence Interval (over 15 years)	Recurring Cost (incl salary, fuel, eqpt)	One-time Cost	Priority	Alt 1	Alt 2	Alt 3
		Flood irrigate hay units to ensure good forage quality		For life of plan	$2,500/yr Alt 1 $1,250/yr Alt 2 $0 Alt 3		M	x	x	
		Use IPM strategies to control invasive plants within hay meadows		Annually	$2,000		H	x	x	x
		Management/admin costs for agricultural habitat NIC above			A1:18,043/yr A2: 23,000/yr A3: 22,600/yr			x	x	x
	Annual Cost **One Time Cost** **Subtotal, Goal 3 (AC × 15 + OTC)**							**23,543** **0** **$353,145**	**36,050-40,050** **2,000** **542,750-602,750**	**36,400** **30,000** **576,000**

Table C-3. Cost to implement the CCP, by alternative.

Objective	Program	Strategy	Project/ Methodology	Recurrence Interval (over 15 years)	Recurring Cost (incl salary, fuel, eqpt)	One-time Cost	Priority	Alt 1	Alt 2	Alt 3
Goal 4. Inventory, Monitoring, Adaptive Management, and Research										
4.1	Inventory Habitat and Wildlife	Conduct Hydro Geomorphic Model (HGM)		1		$80,000	VH		x	x
		Perform topographic LiDAR survey		1		$90,000	VH			
		Evaluate and compare historic and current wetland habitat extent with GIS data		1		$1,500	H		x	x
		Monitor water delivery for surface and groundwater diversions		Annual	$1,250/yr		H	x	x	x
		Identify and document little known vegetation and animal life present on Refuge		1		$10,000	M		x	x
		Annually identify and map invasive species on Refuge		Annual	$10,000/yr		VH		x	x
		Use Contaminant Assessment Process (CAP) to assess potential threat posed by environmental contaminants		2		$5,000 × 2	M	x	x	x
		Continue butterfly survey		Annual	$1,000/yr		H	x	x	x

Table C-3. Cost to implement the CCP, by alternative.

Objective	Program	Strategy	Project/ Methodology	Recurrence Interval (over 15 years)	Recurring Cost (incl salary, fuel, eqpt)	One-time Cost	Priority	Alt 1	Alt 2	Alt 3
		Conduct baseline herptile survey		1		$3,000	M		x	x
		Develop vegetation map for Refuge based upon National Vegetation mapping standards		1		$60,000	VH	x	x	x
4.2	Adaptively Manage and Monitor Responses to Management	Every three years use aerial photography and GIS to assess emergent cover of wetlands			$500 × 5 ($167/yr)					
		Monitor large ungulate use of riparian habitat		Every 3 yrs	$5,000 × 5 ($1,700/yr)		M	x	x	x
		Monitor Camas Creek flows and report to Water District 31		Annual	$2,000/yr		VH	x	x	x
		Monitor water used through all irrigation wells and report to IDWR		Annual	$1,000/yr		VH	x	x	x
		Monitor public notices of intent on modification of water rights in the area		Annual	$100/yr		VH	x	x	x
		Survey and monitor wildlife use in agricultural units		Annual	$500/yr		H	x	x	x

Table C-3. Cost to implement the CCP, by alternative.

Objective	Program	Strategy	Project/ Methodology	Recurrence Interval (over 15 years)	Recurring Cost (incl salary, fuel, eqpt)	One-time Cost	Priority	Alt 1	Alt 2	Alt 3
		Conduct periodic soils test in ag. fields to ensure proper fertilization		Every 5 yrs	$150 × 3 ($30/yr)		M		x	x
		Establish photo points for evaluation of invasive species treatments		Annual	$800/yr		M		x	x
		Annually measure or monitor changes in depth to water on aquifer		Annual	$1,500/yr		M	x	x	x
		Monitor agricultural practices in area surrounding Refuge		Every 5 yrs	$1,000 × 3 ($200/yr)		M		x	x
		Run predictive models to determine the anticipated locations and extent of seasonal wetlands		1		$8,000	H		x	x
4.3	Survey Wildlife and Habitat Trends	Annually conduct standard avian point counts in riparian habitat, stratified by habitat type		Annual	$5,000/yr		H		x	x
		Conduct nest searches for breeding avian focal species		Every 5 yrs	$7,000 x3 ($1,400/yr)		H		x	x

Table C-3. Cost to implement the CCP, by alternative.

Objective	Program	Strategy	Project/ Methodology	Recurrence Interval (over 15 years)	Recurring Cost (incl salary, fuel, eqpt)	One-time Cost	Priority	Alt 1	Alt 2	Alt 3
		Annually conduct secretive marsh bird surveys if State discontinues		Annual	Up to $5,000/yr		M		x	x
		Annually conduct surveys for focal shorebird species		Every 3 yrs	$5,000 × 5 ($1,700/yr)		H		x	x
		Annually survey for reptiles and amphibians stratified by habitat		Annual	$8,000/yr		H		x	x
		Annually assist in conducting tri-State trumpeter swan surveys		Annual	$5,000/yr		M	x	x	x
		Survey focal waterfowl and waterbird species		Annual	$5,000/yr		H		x	x
		Survey fall sandhill crane populations		Annual	$1,500/yr		H	x	x	x
		Weekly survey of eagle roost (Jan-Mar, annually)		Annual	$2,000/yr		H	x	x	x
		Assist IDFG in regional mid-winter bald eagle survey (1day)		Annual	$500		H	x	x	x
		Annually monitor 6-10 of 60 established vegetative trend sites		Annual	$5,000/yr		H		x	x

Table C-3. Cost to implement the CCP, by alternative.

Objective	Program	Strategy	Project/ Methodology	Recurrence Interval (over 15 years)	Recurring Cost (incl salary, fuel, eqpt)	One-time Cost	Priority	Alt 1	Alt 2	Alt 3
		Participate in pollinator monitoring		Every 5 yrs	$5,000 × 3 ($1,000/yr)		L		x	x
		Management/admin costs for inventory and monitoring NIC above			A1: 36,086/yr A2: 46,000/yr A3: 45,200/yr			x	x	x
	Annual Cost **One-Time Cost** **Subtotal, Goal 4 (AC × 15 + OTC)**							**55,136** **70,000** **$897,040**	**107,347** **262,500** **$1,872,705**	**106,547** **262,500** **$1,860,705**
Goal 5. Wildlife-dependent Recreation and Public Use										
5.1	Welcome and Orient Visitors	Construct a combined refuge office, small visitor contact station, and multi-purpose room on headquarters site		1		$350,000 (staff time NIC)	H		x	x
		Develop Outreach and Communications Plan for Refuge, including key messages an audiences and		1	$10,000 ($670/yr)		H		x	x

Table C-3. Cost to implement the CCP, by alternative.

Objective	Program	Strategy	Project/ Methodology	Recurrence Interval (over 15 years)	Recurring Cost (incl salary, fuel, eqpt)	One-time Cost	Priority	Alt 1	Alt 2	Alt 3
		communication strategies								
		Participate in at least one community event annually (1 wk staff time)		Annual	$1,250/yr		M	x	x	x
		Revise Refuge’s general brochure with updated regulations, text, maps and photographs		1		$8,000 (staff time NIC)	M		x	x
		Update panels on informational kiosk in visitor parking area		1		$10,000 (staff time NIC)	M		x	x
		Revise, update, maintain the refuge website (1 wk staff time)		Annual	$1,250/yr		H		x	x
		Host at least one public event per year (A1: 1 wk staff time, A2: 2 wks staff time)		Annual	$1,250/yr $2,500/year (A2,3)		H	x	x	x
5.2	Wildlife Observation and Photography	Maintain a 6.3 mile self-guided auto-tour route that is open year-round to vehicle, foot, and bicycle traffic with 9 pullouts and interpretive panels		Annual	$3,000/yr		H	x	x	x

Table C-3. Cost to implement the CCP, by alternative.

Objective	Program	Strategy	Project/ Methodology	Recurrence Interval (over 15 years)	Recurring Cost (incl salary, fuel, eqpt)	One-time Cost	Priority	Alt 1	Alt 2	Alt 3
		Maintain an additional 6.5 miles of roads that are open seasonally to vehicle traffic for wildlife observation, photography and to provide access to hunting area		Annual	$1,000/yr		M	x	x	x
		Maintain 7.5-mile Sandhole Lake loop road for vehicle traffic		Annual	$1,500/yr		L			x
		Maintain 27 miles of roads open year-round to hiking, bicycling, cross-country skiing and snowshoeing as conditions permit		Annual	$5,000/yr		M	x	x	x
		Groom 10 miles of roads for cross-country skiing, snowshoeing		Annually, as conditions permit	Up to $1,500/yr		L			x
		Develop print and/or digital interpretive media for self-guided tours of the Refuge's Auto-Tour Route, service roads and trails		1		$5,000 (staff time NIC)	M		x	x
		Maintain a 0.5-mile-long birding/walking trail that		Annual	$1,000/yr		H	x		

Table C-3. Cost to implement the CCP, by alternative.

Objective	Program	Strategy / Project/Methodology	Recurrence Interval (over 15 years)	Recurring Cost (incl salary, fuel, eqpt)	One-time Cost	Priority	Alt 1	Alt 2	Alt 3
		starts at visitor center parking lot							
		Complete a 1.3-mile birding/walking trail that starts at the visitor parking lot (have materials)	1		$2,500	H		x	x
		Construct three semipermanent photo blinds, using input from local photographers	1		$6,000	L			x
		Provide visitor sign/in comment station at main parking lot	1		$1,000	M		x	x
5.3	Environmental Education and Interpretation	Provide volunteer-led environmental education programs to approximately 250 students annually	Annual	$1,000/yr		H	x		
		As above, 800 students annually	Annual	$3,200/yr		H		x	
		As above, 2,000 students annually	Annual	$8,000/yr		H			x
		Educ tours, volunteer-led, 6-10 annually	Annual	$2,000/yr		H	x		

Table C-3. Cost to implement the CCP, by alternative.

Objective	Program	Strategy	Project/ Methodology	Recurrence Interval (over 15 years)	Recurring Cost (incl salary, fuel, eqpt)	One-time Cost	Priority	Alt 1	Alt 2	Alt 3
		As above, 10-15 tours annually		Annual	$3,000/yr		H		x	
		As above, 20 tours annually		Annual	$4,000/yr		H			x
	Additional staff time to manage expanded public use programs/ oversee development of facilities and materials under Alts 2,3			Annual	$34,000/yr* *Salary—$34,000/yr (½ Park Ranger). Complex VS position not included				x	x
5.4	Hunting	Program management, upland game/waterfowl hunting (Note: Resource monitoring incl in wildlife and habitat monitoring, above)		Annual	$2,000/yr		H	x	x	x
		Annual cost of printed materials and signage upkeep		Annual	$500/yr		H	x	x	x
		Administer limited hunt for big game (elk). Includes program coordination;		Annual	$8,500/yr		H		x	x

Table C-3. Cost to implement the CCP, by alternative.

Objective	Program	Strategy	Project/ Methodology	Recurrence Interval (over 15 years)	Recurring Cost (incl salary, fuel, eqpt)	One-time Cost	Priority	Alt 1	Alt 2	Alt 3
		recruit/train volunteers; provide orientation; assist mobility impaired hunters, assist with game retrieval outside hunt area								
		Design/print new elk hunt tear sheet; additional signage		1		$4,000	H		x	x
		Provide law enforcement for public safety and to enforce hunting and access regulations (Includes all refuge LE)		Annual	$24,000/yr (.25 Complex LE salary Not included in total)		H	x	x	x
5.5	Friends Group and Volunteers	Develop additional volunteer opportunities; manage larger cadre of volunteers * Salary—assume refuge Park Ranger position spends ¼ time on volunteers. Salary for Complex Visitor Services Manager/Volunteer Coordinator position not included		Annual	$16,250/yr*		H		x	x

Table C-3. Cost to implement the CCP, by alternative.

Objective	Program	Strategy	Project/ Methodology	Recurrence Interval (over 15 years)	Recurring Cost (incl salary, fuel, eqpt)	One-time Cost	Priority	Alt 1	Alt 2	Alt 3
		Staff costs to administer VS programs/manage volunteers NIC above			23,120/yr					
	Annual Cost							41,120	105,240	113,370
	One Time Cost							0	380,500	386,500
	Subtotal, Goal 4 (AC × 15 + OTC)							**$616,800**	**$1,959,100**	**$2,087,050**
	Total Annual Cost							350,000	496,437-500,437	511,317
	Total One Time Cost							78,000	1,161,000	1,195,000
	Total Cost over Lifetime of CCP (AC × 15 +OTC)							**$5,328,000**	**$8,607,555-$8,667,555**	**$8,864,755**

C.2.3 Partnership Opportunities

Partnerships are critically important to the implementation of this plan, which is reflected in Chapter 2’s goals, objectives, and strategies. The Refuge’s ecological significance, and location near the city of Idaho Falls and the Idaho National Laboratory creates many opportunities for partnerships. Current and past partners include Federal and State agencies, the Shoshone-Bannock Tribe, non-governmental organizations, volunteers, and individuals.

Coordinated partnership efforts would focus on habitat restoration, land protection, environmental education, wildlife monitoring, outreach, and quality wildlife-dependent recreation. Refuge staff would work to strengthen existing partnerships and would actively look for new partnerships to assist in achieving the goals, objectives, and strategies in this CCP.

The following is a general list of partners we have established working relationships with through past or current efforts and in formulation of this CCP. These partners support this plan’s vision and have committed to working with the Refuge to implement the plan’s prescribed actions and activities to ensure programmatic integrity for biological, visitor services, sustainable practices and cultural resource programs.

- Shoshone-Bannock Tribe
- Ducks Unlimited, Inc.
- Idaho Fish and Game
- Friends of Camas National Wildlife Refuge
- Continental Divide Weed Management Area
- Snake River and Portneuf Valley Audubon Society
- Idaho State University
- North American Grouse Partnership
- Dubois Grouse Days
- Pheasants Forever
- Upper Snake Sage-grouse Working Group

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Appendix D. Wilderness Review

D.1 Introduction

The Camas National Wildlife Refuge (Refuge) is located in southeast Idaho at an elevation of 4,800 feet. It is situated within the Jefferson County, Idaho 36 miles north of Idaho Falls. The Refuge's approved boundary encompasses 21,500 acres. The original boundary of the Refuge established in E.O. 7720 was approximately 10,922 acres.

D.2 Policy 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 Comprehensive Conservation Planning 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 NWRS 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"). NWRS policy on Wilderness Stewardship (610 FW 1-5) includes guidance for conducting wilderness reviews (610 FW 4, Wilderness Review and Evaluation).

D.2.1 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 NWRS 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 four-wheeled, motorized vehicles that are intended for highway use.

D.2.2 The Wilderness Review Process

A wilderness review is the process of determining whether the Service should recommend NWRS 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 will achieve the purposes of the Wilderness Act and the NWPS
3. how each alternative will affect achievement of refuge purpose(s) and the refuge's contribution toward achieving the Refuge System mission
4. how each alternative will 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 Sec 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 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 will 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).

The following constitutes the inventory phase of the wilderness review for the Camas National Wildlife Refuge.

D.2.3 Previous Wilderness Reviews

There have been no previous wilderness reviews conducted for the Refuge.

D.2.4 Lands Considered Under This Wilderness Review

All Service-owned lands and waters (in fee title) within the Camas National Wildlife Refuge approved boundary were considered during this wilderness review.

D.3 Wilderness Inventory

D.3.1 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 FWS 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.

Camas NWR meets the minimum size requirements for a wilderness area, but the Refuge is subdivided into managed wetland impoundments with a series of man-made dikes and levees.

D.3.2 Naturalness and Wildness

These refer to the area that 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; road 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: 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 a 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.

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 it evolved and 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.

The refuge units are comprised predominately of emergent wetlands, wet meadow, riparian, and shrub habitats. In general, these habitats are comprised of native tree, shrub, forb and grass communities. Wet meadow and upland grass habitats are actively managed to achieve short grass and other successional vegetation stages for waterfowl, sandhill cranes, and shorebirds. This management includes prescribed fire, and haying to achieve refuge purposes for short grass habitats. Invasive plant species are a significant threat to the meadows and uplands, so a variety of Integrated Pest Management techniques are used to keep these species in check. These techniques include: prescribed fire, mechanical manipulation, and herbicide applications. A small portion of the upland areas are farmed for grain crops to provide forage for migratory waterfowl and cranes.

Riparian habitats have been degraded through agricultural water developments, cattle grazing and establishment of invasive plant species. The riparian habitat is in need of restoration, a process which may include the use of herbicides, mechanical equipment, and seeding or transplanting of native species. The natural hydrology of the riparian areas has likewise been altered by upstream water withdrawals and therefore, it does not exhibit the natural dynamics of a functional riparian system.

Sagebrush habitats on the Refuge have been significantly altered through decades of cattle grazing and invasions by non-native plant species, the most notable being cheatgrass. Over 50 percent of the sagebrush habitat is in need of restoration. Management and restoration activities would require prescribed fire, mechanical removal, and herbicide applications.

The refuge unit is intensively managed to provide the habitat conditions necessary for achieving refuge purposes for waterfowl, shorebirds, and other waterbirds. Most of these habitats require some restoration activities over the long term to re-establish the natural vegetation and function of those habitats, and to meet refuge purposes. Due to the current habitat condition and ongoing and proposed management needs, the unit does not meet the criteria for naturalness and wildness.

D.3.3 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 nonmotorized, 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.

Approximately 40 percent of Camas Refuge lands are currently open to public use. Hunting and other wildlife-dependent activities are allowed; camping is not allowed. The individual closed areas are relatively small in size and surrounded by agricultural operations and though they could provide a degree of solitude and primitive recreation to some individuals under certain circumstances (such as the winter months), overall they do not provide outstanding opportunities for solitude or a primitive type of recreation.

D.4 Inventory Summary and Conclusion:

Based on this inventory, the refuge unit does not meet the basic criteria for inclusion into the National Wilderness Preservation System. Only one unit is greater than 5,000 acres, but is subdivided into managed wetland impoundments with a series of man-made dikes and levees. The refuge lands are actively managed for wetland and upland habitat characteristics using a variety of techniques, including grazing, herbicide use for invasive plants, prescribed fire, and mechanical manipulations. Much of the refuge lands have undergone significant degradation due to nearly a century of livestock grazing, hydrologic alterations, and invasions by non-native plant species. These lands do not fulfill the criteria for naturalness and wildness, and therefore do not possess outstanding wilderness character. The Refuge provides some unique recreational opportunities; however, these opportunities are not considered to be outstanding.

Table D.1. Results of Wilderness Inventory for Camas National Wildlife Refuge

Refuge Unit	**(1) Unit Size:** has **at least 5,000 acres of land or is of sufficient size to make practicable its preservation and use in an unconfined condition, or is a roadless island**	**(2) Naturalness and wildness: generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticeable**	**(3a) Outstanding opportunities for solitude**	**(3b) Outstanding opportunities for primitive and unconfined recreation**	**(4) Contains ecological, geological or other features of scientific, educational, scenic, or historical value**	**Area qualifies as a wilderness study area (meets criteria 1,2, and 3a or 3b)**
Camas NWR	Yes	No	No	No	N/A	No

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Appendix E. Refuge Resources of Concern and Priorities

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E.1 Refuge Resources of Concern and Management Priorities

The priorities associated with wildlife and habitat management for a national wildlife refuge are determined through the identification of refuge Resources of Concern. Prioritizing **refuge Resources of Concern** begins with assembling a near comprehensive list of species and habitats that could potentially drive a refuge's management.

The U.S. Fish and Wildlife Service (FWS) has developed a process for formulating the Resources of Concern described in this appendix. It entails first assessing:

- **National Wildlife Refuge System (NWRS) trust resource responsibilities** (i.e., threatened and endangered species and migratory birds) for Camas NWR.
- Species, species groups, and/or communities that support Camas NWR **refuge purposes**.
- Developing a comprehensive list of all the species of Camas NWR and their conservation needs and status as identified in prominent **International, National, Regional, or State ecosystem plans**.

Additional analysis of resources of concern will entail documenting:

- **Biological integrity, diversity, and environmental health** of natural, functional communities such as those found under historic conditions that need to be maintained and, where appropriate, restored at Camas NWR.

Subsequently, refuge staff will then:

- Identify a subset of **Focal Resources** as prioritized Refuge Resources of Concern, by selectively filtering the comprehensive Refuge Resources of Concern list to species and communities that represent the needs of larger groups of species or communities on the Refuge.
- Categorize the highest **Priority** to manage on-Refuge as Focal Resources of Concern by identifying **Priority Habitats**.

This interative process for the identification of resources of concern ultimately concludes in the formulation of the Camas NWR **Conservation Targets**, in which:

- The specific characteristics of Focal Resources are used to describe the attributes required in each priority habitat type requiring management on Camas NWR.

E.1.1 National Wildlife Refuge System Resources of Concern for Camas Refuge

National Wildlife Refuge System (NWRS) Resources of Concern are identified in the National Wildlife Refuge System Mission Goals and Refuge Purposes Policy (601 FWS). The first three NWRS goals (601 FW 1.8) identify the natural resource conservation priorities for the System.

1. Conserve a diversity of fish, wildlife, and plants and their habitats, including species that are endangered or threatened with becoming endangered.

2. Develop and maintain a network of habitats for migratory birds, anadromous and interjurisdictional fish, and marine mammal populations that is strategically distributed and carefully managed to meet important life history needs of these species across their ranges.
3. 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."

Each of these groups of NWRS Resources of Concern is further described below.

- <u>Migratory Birds</u>: A list of all species of migratory birds protected by the Migratory Bird Treaty Act (16 U.S.C. 703-711) and subject to the regulations on migratory birds is contained in subchapter B of title 50 CFR § 10.13. The Migratory Birds Program also maintains subsets of this list that provide priorities at the national, regional, and ecoregional (bird conservation regions) scales.
- <u>Interjurisdictional Fish</u>: Interjurisdictional fish are those " … populations that two or more States, nations, or Native American tribal governments manage because of their geographic distribution or migratory patterns (710 FW 1.5H)." Examples include anadromous species of salmon and free-roaming species endemic to large river systems, such as paddlefish and sturgeon (601 FW 1).
- <u>Threatened and Endangered Species</u>: The Endangered Species Act (16 U.S.C. §§ 1531-1544, December 28, 1973, as amended 1976-1982, 1984, and 1988) states in SEC. 8A.(a) that "The Secretary of the Interior … is designated as the Management Authority and the Scientific Authority for purposes of the Convention and the respective functions of each such Authority shall be carried out through the United States Fish and Wildlife Service." The Act also requires that "all Federal departments and agencies shall seek to conserve endangered species and threatened species and shall utilize their authorities in furtherance of the purposes of this Act."
- <u>Marine Mammals</u>: The Marine Mammal Protection Act of 1972 (16 U.S.C. 13611407) prohibits, with certain exceptions, the take of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the U.S.
- <u>Significant or Rare Communities and Ecosystems</u>: Plant and habitat communities, are also NWRS Resources of Concern when they are rare, declining, underrepresented, represent important ecological/ecosystem processes and/or when they are important in the maintenance or restoration of biological integrity, diversity, and environmental health.

Table E-1. National Wildlife Refuge System Resources of Concern for Camas Refuge

NWRS Resources of Concern	Supporting Resources of Concern for Camas NWR
Migratory Birds:	Over 200 species of migratory birds use the Refuge for breeding or migratory life history events
Interjurisdictional Fish:	N/A: No interjurisdictional fish occur at Camas NWR
Threatened and Endangered Species:	N/A: No ESA listed species occur at Camas NWR at this time
Significant or Rare Communities and Ecosystems:	Sage-grouse; rare neo-tropical migrants; trumpeter swans

E.1.2 Resources of Concern from Refuge Purposes of Camas Refuge

The Refuge System Improvement Act, and subsequent policy, requires that each refuge be managed to fulfill both its establishment purpose and the mission of the Refuge System. The Policy, *National Wildlife Refuge System Mission and Goals and Refuge Purposes* (601 FW 1), explains the relationship between these two. Where there is a conflict, individual refuge purposes have priority.

A detailed discussion of the authorities and purposes of Camas NWR can be found in Chapter 1; there were no individual or groups of species mentioned or identified in the purpose statements of Camas NWR.

E.1.3 Resources of Concern from Regional Wildlife Conservation Plans Applicable to Camas Refuge

A detailed discussion of the resourced of conern in regional wildlife conservation plans that are applicable to Camas NWR can be found in Chapter 1, and are not repeated here.

Table E-2. Comprehensive List of of Camas Refuge Resources of Concern and their Conservation Status

Species	Refuge Purpose Species	Species Abundance	Breeds/Nests Locally	BIDEH	Federal T&E	Birds of Conservation Concern- USFWS R1& BCR 9 and 10	ID Partners in Flight High Priority Species	ID Partners in Flight Mod Priority Species	Idaho Comprehensive Wildlife Conservation Plan Species of Greatest Conservation Need	Intermountain West Regional Shorebird Plan Regionally Important Species	Intermountain West Waterbird Conservation Plan	Intermountain West Coordinated Implementation Plan	N.A. Waterbird Conservation Plan	N.A. Waterfowl Management Plan BCR 9 Breeding/Non-Breeding Need	USFWS Idaho Partners for Fish and Wildlife Program	Conservation Strategy for Southeastern Idaho Wetlands	BLM Sensitive Species	TNC Ecoregional Conservation Plan
FAUNA (Wildlife)																		
Birds																		
Swans																		
Trumpeter swan *Cygnus buccinator*		c	x				26 (ID)		G4/S1B,S 2N SRB-			PA W		H/H	x	x	Typ e 3	x-CP
Tundra Swan *Cygnus columbianus*		cSp, oF							G5/S4B, S3N					/H				
Geese																		
Canada goose *Branta canadensis moffitti*		a	x						G5/S5B, S5N					/H				
Greater white-fronted goose *Anser albifrons*		rSp, rF							G5/SNA					/H				
Snow goose *Chen caerulescens*		cS, rS; rF							G5/SNA					/M				
Ross's Goose *Chen rossii*		cSp, rS, rF							G5/SNA					/M				
Dabbling Waterbirds																		
American green-winged teal *Anas crecca*		c	x						G5/S4B, S3N					ML/MH				
American		c	x						G5/S5B,					MH/ML				

Species	Refuge Purpose Species	Species Abundance	Breeds/Nests Locally	BIDEH	Federal T&E	Birds of Conservation Concern- USFWS R1& BCR 9 and 10	ID Partners in Flight High Priority Species	ID Partners in Flight Mod Priority Species	Idaho Comprehensive Wildlife Conservation Plan Species of Greatest Conservation Need	Intermountain West Regional Shorebird Plan Regionally Important Species	Intermountain West Waterbird Conservation Plan	Intermountain West Coordinated Implementation Plan	N.A. Waterbird Conservation Plan	N.A. Waterfowl Management Plan BCR 9 Breeding/Non-Breeding Need	USFWS Idaho Partners for Fish and Wildlife Program	Conservation Strategy for Southeastern Idaho Wetlands	BLM Sensitive Species	TNC Ecoregional Conservation Plan
widgeon *Anas americana*									S3N									
Blue-winged teal *Anas discors*		uSp, cS; oF	x						G5/S5B									
Cinnamon teal *Anas cyanoptera*		cSp, cS; uF	x				21 (80)		G5/S5B					MH/				
Gadwall *Anas strepera*		a	x						G5/S5B, S3N					MH/				
Mallard *Anas platyrhynchos*		a	x						G5/S5B, S4N					M/H				
Northern pintail *Anas acuta*		c	x						G5/S5B,S 2N SRB-A					M/				
Northern shoveler *Anas clypeata*		c	x						G5/S5B, S2N					ML/MH				
Wood duck *Aix sponsa*		oSp, rS; rF	x					19* (64)	G5/S4B, S3N					ML/ML				
Diving Waterbirds																		
Barrow's goldeneye *Bucephala islandica*		r					24* (64)		G5/S4B, S3N					H/MH			Ty pe 5	
Bufflehead *Bucephala albeola*		cSp, oS; uF						18* (ID)	G5/S4B, S3N					ML/MH				

Species	Refuge Purpose Species	Species Abundance	Breeds/Nests Locally	BIDEH	Federal T&E	Birds of Conservation Concern-USFWS R1& BCR 9 and 10	ID Partners in Flight High Priority Species	ID Partners in Flight Mod Priority Species	Idaho Comprehensive Wildlife Conservation Plan Species of Greatest Conservation Need	Intermountain West Regional Shorebird Plan Regionally Important Species	Intermountain West Waterbird Conservation Plan	Intermountain West Coordinated Implementation Plan	N.A. Waterbird Conservation Plan	N.A. Waterfowl Management Plan BCR 9 Breeding/Non-Breeding Need	USFWS Idaho Partners for Fish and Wildlife Program	Conservation Strategy for Southeastern Idaho Wetlands	BLM Sensitive Species	TNC Ecoregional Conservation Plan
Canvasback *Aythya valisineria*		c	x						G5/S4B, S2N					ML/MH				
Common goldeneye *Bucephala clangula*		cSp, oS; cF							G5/S4B, S3N					ML/ML				
Common loon *Gavia immer*		r							G5/S1B,S 2N		High	PA W						
Common Merganser *Mergus merganser*		uSp, rS; oF							G5/S5B, S3N									
Hooded Merganser *Lophodytes cucullatus*		uSp, oF					22 (64)		G5/S2B,S 3N SRB-									
Lesser scaup *Aythya affinis*		c	x					17 (ID)	G5/S3 SRB-					M/M				
Greater Scaup *Aytha fuligula*		rSp, oF							G5/SNR					ML/MH				
Red-breasted merganser *Mergus serrator*		o							G5/S4B, S3N									
Redhead *Aythya americana*		c	x				22 (89)		G5/S5B, S3N					MH/MH				
Ring-necked duck *Aythya collaris*		o	x					20 (64)	G5/S3B, S3N					ML/ML				
Ruddy duck		a	x						G5/S5B					M/M				

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Oxyura jamaicensis																		
Grebes																		
Clark's grebe *Aechmophorus clarkii*		o	x					20* (ID)	G5/S2B SRB-		Mod-10		Low-NA					
Eared grebe *Podiceps nigricollis*		c	x					15 (ID)	G5/S4B		High -9 Staging		Mod-COS			x		
Horned grebe *Podiceps auritus*		oSP, oF							G5/SNA									
Pied-billed grebe *Podilymbus podiceps*		u	x						G5/S4B, S3N									
Western grebe *Aechmorphus occidentalis*		u	x				22 (ID)		G5/S2B SRB-		Mod-10 High -9		Mod-NA			x		
Pelicans and Cormorants																		
American white pelican *Pelecanus erythroryhchos*		u	x				24 (ID)		G3/S1B SRB-		High	PAW	Mod-NA			x	Type 2	x-CP
Double crested cormorant *Phalacrocorax auritus*		u							G5/S2B							x		
Wading Birds																		

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American avocet *Recurvirostra americana*		uSp, cS; oF	x			9	23 (80)		G5/S5B SRB-	High 5/3/3								
American bittern *Botaurus lentiginosus*		o	x						G4/S4B		Mod-10							
Black-crowned night-heron *Nycticorax nycticorax*		c	x						G5/S2B SRB-A		Mod-9		Mod-COS			x		
Black-necked stilt *Himantopus mexicanus*		uSp, uS; rF	x				18 (80)		G5/S3B SRB-	High 5/3/3								
Cattle egret *Bubulcus ibis*		r							G5/S2B SRB-							x		
Great egret *Ardea alba*		o							G5/S1B SRB-									
Snowy egret *Egretta thula*		u						14 (80)	G5/S2B SRB-		Mod-10 High -9		High -WH			x		x-CP
Great blue heron *Ardea herodias*		u							G5/S5B, S5N									
Sandhill crane (Greater) *Grus canadensis tabida*		c	x				24 (ID)		G5/S3B SRB-		High -9	PB Ag			x			
Marsh Birds																		
American coot *Fulica*		a	x						G5/S5B									

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americana																		
Sora *Porzana Carolina*		u	x						G5/S5B									
Virginia rail *Rallus limicola*		u	x						G5/S5B									
White-faced ibis *Plegadis chihi*		cSp, uS; uF	x				20 (89)		G5/S2B SRB-A		Mod	PA W	Low-WH		x	x	Ty pe 4	
Shorebirds																		
Black-bellied plover *Pluvialis squatarola*		oSp, rS; oF							G5/SNA	Low 2/1/1								
Greater yellowlegs *Tringa melanoleuca*		u							G5/SNA	Mod 3/3/3								
Semipalmated sandpiper *Calidris pusilla*		o							G5/SNA	Low 1/1/1								
Stilt Sandpiper *Calidris himantopus*		oF							G5/SNA	Low 1/1/1								
Wilson's snipe *Gallinago delicata*		uSp, cS, uF, rW	x						G5/SNA									
Killdeer *Charadrius vociferus*		c	x				19 (ID)		G5/SNA	Mod 3/2/1								

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Long-billed curlew *Numenius americanus*		cSp, cS; oF	x			R1; 9; 10	23 (80)		G5/S2B SRB-A;NNH;SXS	Very High 5/4/3		PB G/Ag			x		Type 5	x-CP
Pectoral sandpiper *Calidris melanotos*		rSp, rS; oF								Low 1/1/1								
Red-necked phalarope *Phalaropus lobatus*		u								Mod 4/1/1								
Willet *Tringa semipalmata*		cSp, cS; uF	x						G5/S4B	High 4/3/2								
Wilson's phalarope *Phalaropus tricolor*		cSp, cS; uF	x			9; 10;		21 (69)	G5/S3B SRB-	High 5/3/1		PA W					Type 5	
Western sandpiper *Calidris mauri*		oSp; uS; uF							G5/SNA	Mod 4/2/2								
Least sandpiper *Calidris minutilla*		oSp, uS; uF							G5/SNA	Mod 4/2/2								
Baird's sandpiper *Calidris bairdii*		oSp, rS, uF							G5/SNA	Low 1/1/1								
Spotted sandpiper		u	x						G5/S5B	Mod 3/3/3								

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Actitis macularia																		
Long-billed dowitcher *Limnodromus scolopaceus*		uSp; oS; uF							G5/SNA	Mod 5/2/2								
Marbled Godwit *Limosa fedoa*		uSp, uS, oF;				9; 10;			G5/SNA	High 4/1/1								
Solitary sandpiper *Tringa solitaria*		uSp, oS; oF				9, 10;			G5/SNA	Mod 2/2/3								
Semipalmated plover *Charadrius semipalmatus*		oSp, rS; oF							G5/SNA	Mod 3/1/1								
Lesser yellowlegs *Tringa flavipes*		u							G5/SNA	Low 2/2/2								
Terns and Gulls																		
Black tern *Chlidonias niger*		u	x					18* (ID)	G4/S1B SRB-		High	PA W	Mod-COS			x	Ty pe 3	x CP
Bonaparte's Gull *Chroicocephalus philadelphia*		Usp, uF							G5/SNA									
Franklin's Gull *Leucophaeus pipixcan*		c	x				24 (80)		G4G5/ S2B SRB-A		High		Mod-WH			x		x-CP

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Forster's tern *Sterna forsteri*		cSp, uS; uF	x						G5/S1B SRB-		High -10 Mod- 9		Mod- NA			x		x-CP
Ring-billed gull *Larus delawarensis*		cSp, uS; cF	x						G5/S3B, S3N									
California gull *Larus californicus*		cSp, uS; uF						19 (ID)	G5/S2B,S 3N SRB-A		Mod- 10		Mod- NA			x		
Caspian tern *Hydroprogne caspia*		o							G5/S2B,S 3N SRB				Low- COS			x		
Common tern *Sterna hirundo*		oSp, oF							G5/S1B		Mod- 10							
Raptors																		
American kestrel *Falco sparverius*		c	x						G5/S5B, S5N									
Bald eagle *Haliaeetus leucocephalus*		uSp, oS, uF, cW	x		FT				G4/S3B,S 4N SRB-			PA R					Ty pe 1	x-CP
Burrowing owl *Speotyto cunicularia*		rSp, rS	x			R1; 9		19* (ID)	G4/S2B SRB- A;NNH;S XS			PB Ag					Ty pe 5	x-CP
Cooper's hawk *Accipiter cooperii*		oSp, oS, uF, rW	x						G5/S4									

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Golden eagle *Aquila chrysaetos*		o	x			9; 10	19 (89)		G5/S4B, S4N									
Great-gray owl *Strix nebulosa*		rW	x						G5/S3								Type 5	
Great-horned owl *Bubo virginianus*		c	x						G5/S5									
Barn owl *Tyto alba*		oSp, rS, oF							G5/S5									
Ferruginous hawk *Buteo regalis*		uSp, uS, oF	x			9; 10	23 (ID)		G4/S3B SRB-								Type 3	x CP
Long-eared owl *Asio otus*		oSp, uS, oF	x						G5/S5									x-CP
Merlin *Falco columbarius*		oSp, rS, oF							G5/S2B,S2N SRB-A; NNH; SXS									
Northern goshawk *Accipiter gentilis*		r					21 (64)		G5/S3								Type 3	x CP
Northern harrier *Circus cyaneus*		c	x					18 (80)	G5/S5B, S5N									x-CP
Northern saw-		r	x						G5/S3									

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whet owl *Aegolius acadicus*																		
Osprey *Pandion haileatus*		oSp, rS, oF						17 (ID)	G5/S5B									
Peregrine falcon *Falco peregrinus*		o	x		FCo	R1;9; 10		19 (ID)	G4T3/ S2B SRB- NNH; SXS; DCR							x	Ty pe 3	x-CP
Prairie falcon *Falco mexicanus*		o				R1; 9; 10	24 (80)		G5/S4B, S3N			PB G					Ty pe 3	
Red-tailed hawk *Buteo jamaicensis*		c	x						G5/S5B, S5N									
Rough-legged hawk *Buteo lagopus*		uSp, uF; cW							G5/S4N									
Sharp-shinned hawk *Falco striatus*		oSp, oS, uF, rW					18 (64)		G5/S5									
Short-eared owl *Asio flammeus*		u	x				23 (ID)		G5/S4 SRB-								Ty pe 5	
Swainson's hawk *Buteo swainsoni*		c	x			R1; 9; 10	21 (89)		G5/S3B SRB-								Ty pe 5	

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Turkey Vulture *Cathartes aura*		uSp, oS, uF							G5/S3B									
Corvids																		
American crow *Corvus brachyrhynchos*		cSp, cS, uf, uW	x						G5/S5									
Common raven *Corvus corax*		u							G5/S5									
Black-billed magpie *Pica pica*		a	x				19 (ID)		G5/S5									
Steller's jay *Cyanocitta stelleri*		rSp, oF, rW							G5/S5									
Clark's nutcracker *Nucifraga columbiana*		r						18 (ID)	G5/S5									
Upland Game Birds																		
Ring-necked pheasant (Exotic) *Phasianus colchicus*		uSp, uS, cF, cW	x						G5/SNA									
Gray partridge (Exotic) *Perdix perdix*		u	x						G5/SNA									

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Greater sage-grouse *Centrocercus urophasianus*		oSp, oS, uF, uW	x			R1;9	25 (ID)		G4/S2 SRB-A; SXS			PA SB/S DS			x		Ty pe 2	x-CP
Doves																		
Mourning dove *Zenaida macroura*		c Sp, cS, cF, rW	x						G5/S5B									
Rock dove (introduced sp.) *Columba livia*		o	x	x					G5/SNA									
Passerines and other Birds																		
(Goatsuckers)																		
Common night hawk *Chordeiles minor*		uSp, cS; oF	x						G5/S5B									
Common poorwill *Phalaenoptilus nuttallii*		r							G5/S4B									
(Hummingbirds)																		
Black-chinned hummingbird *Archilocus alexandri*		oSp, oS; uF							G5/S5B									
Calliope hummingbird		oSp ;					23 (ID)		G5/S5B			PA R					Ty pe	

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Selasphorus calliope		uS; oF															3	
Broad-tailed hummingbird *Selasphorus platycercus*		o							G5/S5B									
Rufous hummingbird *Selasphorus rufus*		rSp; uS; oF					22 (89)		G5/S5B									
(Kingfishers)																		
Belted kingfisher *Ceryle alcyon*		uSp, oS, uF							G5/S5									
(Woodpeckers)																		
Lewis' woodpecker *Melanerpes lewis*		oSp, rF				R1; 9; 10	23 (ID)		G4/S3B SRB-								Type 3	x-CP
Red-naped sapsucker *Sphyrapicus nuchalis*		uSp, uF				R1; 10		21 (64,80)	G5/S5B								Type 5	
Williamson's sapsucker *Sphyrapicus thyroideus*		r				R1; 9; 10	22 (64)		G5/S3B								Type 3	
Downy woodpecker *Picoides pubescens*		u	x						G5/S5									

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Hairy woodpecker *Picoides villosus*		o							G5/S5									
Three-toed woodpecker *Picoides tridactylus*		rSp; oS, F	x						G5/S2 SRB-									
Northern flicker *Colaptes auratus*		c	x					15 (ID)	G5/S5									
(Flycatchers)																		
Olive-sided flycatcher *Contopus cooperi*		uSp, uS, oF				R1;	21 (ID)		G5/S3B								Ty pe 3	
Western wood pewee *Contopus sordidulus*		c	x					17 (ID)	G5/S5B									
Willow flycatcher *Empidonax traillii*		cSp, cS, uF	x				21 (ID)		G5/S5B			PA R					Ty pe 3	
Hammond's flycatcher *Empidonax hammondii*		uSp, uS, cF					23 (ID)		G5/S5B								Ty pe 3	
Gray Flycatcher *Empidonax wrightii*		o					24 (80, 89)		G5/S3B									x CP

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Dusky flycatcher *Empidonax oberholseri*		cSp, uS, uF					22 (64)		G5/S5B									
Western kingbird *Tyrannus verticalis*		cSp, cS, uF	x						G5/S5B									
Eastern kingbird *Tyrannus tyrannus*		cSp, cS, uF	x						G5/S4B									
Cordilleran flycatcher *Empidonax occidentalis*		u							G5/S4B									
Least flycatcher *Empidonax minimus*		oSp, rS, oF							G5/SNA									
(Larks)																		
Horned lark *Eremophila alpestris*		uSp, uS, cF, cW	x			R1			G5/S5			PA SB/S DS						
(Swallows)																		
Tree swallow *Tachycineta bicolor*		cSp, cS, uW	x						G5/S5B									
Violet-green swallow *Tachycineta thalassina*		uSp, uS, oF	x					17 (ID)	G5/S5B									

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Northern rough-winged swallow *Stelgidoptyerx serripennis*		cSp, cS, uF	x						G5/S5B									
Bank swallow *Riparia riparia*		u							G5/S5B									
Cliff swallow *Petrochelidon pyrrhonota*		cSP; cS; uF	x						G5/S5B									
Barn swallow *Hirundo rustica*		c	x						G5/S5B									
(Chickadees and Titmice)																		
Black-capped chickadee *Poecile atricapillus*		u	x					13 (ID)	G5/S5									
Mountain chickadee *Poecile gambeli*		rSp, rS, oF, oW						16 (ID)	G5/S5									
(Creepers and Nuthatches)																		
Brown creeper *Certhia americana*		o					18 (64)		G5/S5									
Red-breasted nuthatch *Sitta canadensis*		uSp, oS, uF, rW							G5/S5									
White-breasted		r							G5/S4									

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nuthatch *Sitta carolinensis*																		
(Wrens)																		
Rock wren *Salpinctes obsoletus*		o	xx				19 (89)		G5/S5B									
House wren *Troglodytes aedon*		cSp, cS; uF					X2		G5/S5B									
Winter wren *Ttoglodytes troglodytes*		oSp, oF							G5/S5									
Marsh wren *Cistothorus palustris*		c	x						G5/S5B									
(Kinglets, Bluebirds, Thrushes)																		
Golden-crowned kinglet *Regulus satrapa*		oSp, oF							G5/S5									
Ruby-crowned kinglet *Regulus calendula*		cSp, uS, cF							G5/S5B									
Mountain bluebird *Sialia currucoides*		oSp, oF							G5/S4B									
Townsend's		o						19	G5/S5									

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solitaire *Myadestes townsendi*								(ID)										
Veery *Catharus fuscesens*		o						19* (ID)	G5/S5B									x CP
Swainson’s thrush *Catharus ustulata*		cSp, uS, uF							G5/S5B									
Hermit thrush *Catharus guttatus*		cSp, uS, cF							G5/S5B									
American robin *Turdus migratorius*		a	x						G5/S5B, S3N									
Ovenbird *Seiurus aurocapilla*		oSp, oS							G5/SNA									
Northern waterthrush *Parkesia noveboracensis*		oSp, oS, uF							G5/S4									
Blue-gray gnatcatcher *Polioptila caerulea*		oSp, rS, oF							G5/S5									
(Mockingbirds and Thrashers)																		
Gray catbird *Dumetella*		uSp, oS,							G5/S5B									

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carolinensis		uF																
Sage thrasher *Oreoscoptes montanus*		u	x				22 (89)		G5/S3B			PA SB/S DS					Ty pe 5	x-CP
(Pipits)																		
American pipit *Anthus rubescens*		uSp, uF							G5/S4B									
(Waxwings)																		
Bohemian waxwing *Bombycilla garrulus*		o							G5/S1B. S3N									
Cedar waxwing *Bombycilla cedrorum*		u							G5/S5B. S3N									
(Shrikes)																		
Northern shrike *Lanius excubitor*		o							G5/S5N									
Loggerhead shrike *Lanius ludovicianus*		oSP ,uS, oF	x			R1; 9; 10	20 (80)		G5/S3								Ty pe 3	x-CP
(Starlings)																		
European starling (Exotic) *Sturnus vulgaris*		a	x						G5/SNA									
(Vireos)																		
Warbling vireo *Vireo gilvus*		uSp, cS, uF	x					18 (ID)	G5/S5B									

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Plumbeous vireo *Vireo plumbeus*		oSp, oS, oF							G5/S4									
Cassin's vireo *Vireo cassinii*		uSp, oS, uF							G5/S5B									
Red-eyed vireo *Vireo olivaceus*		o							G5/S5B									
(Warblers)																		
Orange-crowned warbler *Vermivora celata*		uSp, uS, cF							G5/S5B									
Yellow warbler *Setophaga petechia*		aSp, aS, cF	x				18 (64)		G5/S5B									
Yellow-rumped warbler *Setophaga coronata*		cSp, uS, aF						16 (64)	G5/S5B									
Yellow-breasted chat *Icteria virens*		o																
Townsend's warbler *Setophaga townsendii*		uSp, oS, uF					22 (ID)		G5/S4B									
American redstart *Setophaga ruticilla*		uSp, oS, oF							G5/S4B									

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MacGillivary's warbler *Oporornis tolmiei*		cSp, uS, cF					21 (ID)		G5/S5B									x CP
Common yellowthroat *Geothlypis trichas*		cSp, cS, uF	x						G5/S5B									
Wilson's warbler *Cardellina pusilla*		cSp, uS, aF							G5/S5B									x CP
Nashville warbler *Oreothlypis ruficapilla*		oSp, oS, uF							G5/S5B									
Black-throated Gray warbler *Setophaga nigrescens*		o							G5/SNA									
Blackpoll warbler *Setophaga striata*		rSp, rS, oF							G5/SNA									
(Tanagers)																		
Western tanager *Piranga ludoviciana*		cSp, uS, uF					20 (ID)		G5/S5B									
(Grossbeaks and Buntings)																		
Rose-breasted		r							G5/SNA									

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grosbeak *Pheucticus ludovicianus*																		
Black-headed grosbeak *Pheucticus melanocephalus*		cSp, cS, uF	x						G5/S5B									
Lazuli bunting *Passerina amoena*		u	x					19 (64)	G5/S5B									
(Towhees and Sparrows)																		
Green-tailed towhee *Pipilo chlorurus*		oSp, rS, oF						19 (ID)	G5/S5B								Ty pe 5	x-CP
Grasshopper sparrow *Ammodramus savannarum*		uSp, uS, oF	x				20 (64)		G5/S2B SRB-NNH; SXS			PB G					Ty pe 5	x-CP
House sparrow (Exotic) *Passer domesticus*		u	x						G5/SN									
Chipping sparrow *Spizella passerina*		uSp, uS, cF							G5/S5B									
Brewer's sparrow *Spizella breweri*		uSp, cS, uF	x			R1; 9; 10	24 (89)		G5/S3B SRB-			PA SB/S DS					Ty pe 3	x CP

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Vesper sparrow *Pooecetes gramineus*		cSp, cS; uF	x					16 (80)	G5/S4B									
Lark sparrow *Chondestes grammacus*		u	x				20 (89)		G5/S5B									
Savannah sparrow *Passerculus sandwichensis*		c	x						G5/S5B									
Fox sparrow *Passerella iliaca*		r							G5/S5B									
Sage sparrow *Artemisospiza belli*		o	x			9	25 (80; 89)		G5/S3B			PA SB/S DS					Ty pe 3	x-CP
Song sparrow *Melospiza melodia*		c	x						G5/S5B, S5N									
Lincoln's sparrow *Melospiza lincolnii*		uSp, oS, uF							G5/S5B									
White-crowned sparrow *Zonotrichia leucophrys*		cSp, oS, cF							G5/S5B, S4N									
Dark-eyed junco *Junco hyemalis*		uSp, rS, cF, oW						13 (ID)	G5/S5									
Snow bunting		rSp,							G5/S4N									

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Plectrophenax nivalis		rF, oW																
Spotted towhee *Pipilo maculatus*		oSp, oF							G5/S5B									
American tree sparrow *Spizella arborea*		o							G5/S5N									
White-throated sparrow *Zonotrichia albicollis*		rSp, oF							G5/SNA									
(Blackbirds, Meadowlarks, and Orioles)																		
Brown-headed cowbird *Sitta pusilla*		aSp, aS; uF	x						G5/S5B									
Brewer's blackbird *Euphagus cyanocephalus*		aSp, aS; uF	x					15 (ID)	G5/S5B, S5N								Ty pe 3	
Red-winged blackbird *Agelaius phoeniceus*		a	x						G5/S5B, S3N									
Western meadowlark *Sturnella neglecta*		c	x				18 (ID)		G5/S5B, S3N									
Yellow-headed blackbird		aSp, aS,	x					18 (80)	G5/S5B									

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Xanthocephalus xanthocephalus		cF																
Common grackle *Quiscalus quiscala*		r							G5/S3B									
Bullock's Oriole *Icterus bullockii*		cSp, cS, rF	x					19* (ID)	G5/S5B									
(Finches)																		
Cassin's finch *Haemorhous cassini*		oSp, rS, oF						19 (ID)	G5/S5									
Common redpoll *Acanthis flammea*		rW							G5/S4N									
House finch *Haemorhous mexicanus*		o	x						G5/S5									
Pine siskin *Spinus pinus*		uSp, oS, uF, rW						14 (ID)	G5/S5									
American goldfinch *Spinus tristus*		cSp, cS, uF, uW	x						G5/S5									
Evening grosbeak *Coccothraustes vespertinus*		r							G5/S5									

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Mammals																		
Black bear *Ursus americanus*		c	x						G5/S5									
Badger *Taxidea taxus*		c	x						G5/S5									
Bobcat *Felix rufus*		r	x						G5/S5									
Gray wolf *Canis lupus*		r			FE				G4/S3									
Coyote *Canis latrans*		c	x						G5/S5									
Deer mouse *Peromyscus maniculata*		c	x						G5/S5									
Domestic cat *Felis domesticus*		c	x															
Domestic dog *Canis familiaris*		c	x															
Ermine *Mustela erminea*		u	x						G5/S5									
Long-tailed weasel *Mustela frenata*		unk							G5/S5									
Mink *Mustela vison*		U	x						G5/S5									
River otter *Lontra canadensis*		r							G5/S4									
Meadow vole		c	x						G5/S5									

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Microtus pennsylvaticus																		
Montane vole *Microtus montanus*		c	x						G5/S5									
Mountain lion *Felix concolor*		r	x						G5/S5									
Raccoon *Procyon lotor*		c	x						G5/S4									
Red fox *Vulpes vulpes*		c	x						G5/S5									
Western spotted skunk *Spilogale gracilis*		unk							G5/S5									
Striped skunk *Mephitis mephitis*		c	x						G5/S5									
Yellow-bellied marmot *Marmota flaviventris*		c	x						G5/S5									
Townsend's ground squirrel *Spermophilus townsendii*		unk																
Wyoming ground squirrel *Spermophilus elegans*									G5/S3 SRB- A; NNH; SXS									
Uinta ground									G5/S4									

Species	**Refuge Purpose Species**	**Species Abundance**	**Breeds/Nests Locally**	**BIDEH**	**Federal T&E**	**Birds of Conservation Concern-USFWS R1& BCR 9 and 10**	**ID Partners in Flight High Priority Species**	**ID Partners in Flight Mod Priority Species**	**Idaho Comprehensive Wildlife Conservation Plan Species of Greatest Conservation Need**	**Intermountain West Regional Shorebird Plan Regionally Important Species**	**Intermountain West Waterbird Conservation Plan**	**Intermountain West Coordinated Implementation Plan**	**N.A. Waterbird Conservation Plan**	**N.A. Waterfowl Management Plan BCR 9 Breeding/Non-Breeding Need**	**USFWS Idaho Partners for Fish and Wildlife Program**	**Conservation Strategy for Southeastern Idaho Wetlands**	**BLM Sensitive Species**	**TNC Ecoregional Conservation Plan**
squirrel *Spermophilus armatus*																		
Least chipmunk *Tamius minimus*			x						G5/S5									
Great Basin ground squirrel *Spermophilus mollis*									G5/S2 SRB-								Ty pe 3	
Idaho pocket gopher *Thomomys idahoensis*									G4/S3 SRB-									
Northern pocket gopher *Thomomys talpoides*		a	x						G5/S5									
Beaver *Castor canadensis*		c	x						G5/S5									
Ord's kangaroo rat *Dipodomys ordii*		c	x						G5/S5									
Northern grasshopper mouse *Onychomys leucogaster*		unk							G5/S4									x CP
Western harvest mouse *Reithrodontomys*		unk							G5/S5									

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megalotis																		
Sagebrush vole *Lagurus curtatus*		unk							G5/S4									x CP
Western jumping mouse *Zapus princeps*		unk							G5/S5									
Great Basin pocket mouse *Perognathus parvus*		unk							G5/S5									
Muskrat *Ondatra zibethicus*	x	c	x						G5/S5									
Porcupine *Erethizon dorsatum*									G5/S5									
Elk *Cervus elaphus*		c	x						G5/S5									
Pronghorn *Antilocapra americana*		c	x						G5/S5									
White-tailed Deer *Odocoileus virginianus*		c	x						G5/S5									
Mule Deer *Odocoileus hemionus*		u	x						G5/S5									
Moose *Alces alces*		c	x						G5/S5									

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Mountain cottontail *Sylvilagus nuttalli*		u	x						G5/S5									
White-tailed jackrabbit *Lepus townsendii*		u	x						G5/S5									
Pygmy rabbit *Brachylagus idahoensis*									G4/S2 SRB-SXS								Type 2	x CP
Bushy-tailed woodrat *Neotoma cinerea*		r							G5/S5									
Merriam's shrew *Sorex merriami*									G5/S2 SRB-NNH; SXS								Type 3	x CP
Water Shrew *Sorex palustris*		unk							G5/S4									
Vagrant shrew *Sorex vagrans*			x						G5/S4									
Spotted bat *Euderma maculatum*									G4/S3 SRB-SXS									x CP
Little brown myotis *Myotis lucifugus*		unk							G5/S5									
Yuma myotis *Myotis*		unk							G5/S3									

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yumanensis																		
Western small-footed myotis *Myotis ciliolabrum*		unk							G5/S3									
Big brown bat *Eptesicus fuscus*		unk							G5/S4									
Townsend's big-eared bat *Corynorhinus townsendii*									G4/S3 SRB-NNH; DCR									x CP
Amphibians																		
Tiger salamander *Ambyystoma tigrinum*		r	x						G5/S5									
Great Basin spadefoot *Spea intermontanus*		unk							G5/S4									
Western toad *Bufo boreas*									G5/S3									x CP
Striped chorus frog *Pseudacris triseriata*																		
Northern Leopard frog *Rana pipiens*									G5/S2 SRB-SXS								Type 2	x CP

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Reptiles																		
Common sagebrush lizard *Sceloporus graciosus*									G5/S5									
Greater short-horned lizard *Phrynosoma douglassi*									G5/SNR									x CP
Western skink *Eumeces skiltonianus*									G5/S5									
Gophersnake *Pituophis catenifer*									G5/S5									
Terresterial garter snake *Thamnophis elegans*		c	x						G5/S5									
Common garter snake *Thamnophis sirtalis*									G5/S3									
Eastern racer *Coluber constrictor*									G5/S5									
Western Rattlesnake *Crotalus viridus*									G5/S5									
Ring-necked Snake									G5/S2 SRB-								Ty pe	

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Diadophis punctatus									SXS								5	
Fish																		
Utah chub *Gila atraria*									G5/S4									
Utah sucker *Catostomus ardens*									G5/S5									
Brown Bullhead *Ameiurus nebulosus*									G5/SNA									
Yellow Perch *Perca flavescens*									G5/SNA									
Largemouth Bass *Micropterus salmoides*									G5/SNA									
Butterflies																		
Anise Swallowtail *Papilio zelicaon*									G5/SNR									
Western Tiger Swallowtail *Papilio rutulus*									G5/SNR									
Checkered White *Pontia protodice*																		
Western White *Pontia*									G5/SNR									

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occidentalis																		
Becker's White *Pontia beckerii*									G5/SNR									
Cabbage White *Pieris rapae*									G5/SNA									
Clouded Sulphur *Colias philodice*									G5/SNR									
Orange Sulfur *Colias eurytheme*																		
Queen Alexandra's Sulfur *Colias alexandra*																		
Ruddy Copper *Lycaena rubidus*									G5/SNR									
Purplish Copper *Lycaena helloides*									G5/SNR									
Melissa Blue *Lycaeides melissa*									G5/SNR									
Western Pygmy Blue *Brephidium exile*									G5/SNR									
Dotted Blue *Euphilotes enoptes*																		
Callippe									G5/SNR									

Species	Refuge Purpose Species	Species Abundance	Breeds/Nests Locally	BIDEH	Federal T&E	Birds of Conservation Concern- USFWS R1& BCR 9 and 10	ID Partners in Flight High Priority Species	ID Partners in Flight Mod Priority Species	Idaho Comprehensive Wildlife Conservation Plan Species of Greatest Conservation Need	Intermountain West Regional Shorebird Plan Regionally Important Species	Intermountain West Waterbird Conservation Plan	Intermountain West Coordinated Implementation Plan	N.A. Waterbird Conservation Plan	N.A. Waterfowl Management Plan BCR 9 Breeding/Non-Breeding Need	USFWS Idaho Partners for Fish and Wildlife Program	Conservation Strategy for Southeastern Idaho Wetlands	BLM Sensitive Species	TNC Ecoregional Conservation Plan
Fritillary *Speyeria callippe*																		
Coronis Fritillary *Speyeria coronis*									G5/SNR									
Field Crescent *Phyciodes campestris*									G5/SNR									
Mylitta Crescent *Phyciodes mylitta*									G5/SNR									
California Tortoiseshell *Nymphalis californica*									G5/SNR									
Mourning Cloak *Nymphalis antiopa*									G5/SNR									
Milbert's Tortoiseshell *Nymphalis milberti*									G5/SNR									
Red Admiral *Vanessa atalanta*									G5/SNR									
West Coast Lady *Vanessa annabella*									G5/SNA									
Painted Lady									G5/SNR									

Species	**Refuge Purpose Species**	**Species Abundance**	**Breeds/Nests Locally**	**BIDEH**	**Federal T&E**	**Birds of Conservation Concern- USFWS R1& BCR 9 and 10**	**ID Partners in Flight High Priority Species**	**ID Partners in Flight Mod Priority Species**	**Idaho Comprehensive Wildlife Conservation Plan Species of Greatest Conservation Need**	**Intermountain West Regional Shorebird Plan Regionally Important Species**	**Intermountain West Waterbird Conservation Plan**	**Intermountain West Coordinated Implementation Plan**	**N.A. Waterbird Conservation Plan**	**N.A. Waterfowl Management Plan BCR 9 Breeding/Non-Breeding Need**	**USFWS Idaho Partners for Fish and Wildlife Program**	**Conservation Strategy for Southeastern Idaho Wetlands**	**BLM Sensitive Species**	**TNC Ecoregional Conservation Plan**
Vanessa cardui																		
Viceroy *Limenitis archippus*									G5/SNR									
Common Wood Nymph *Cercyonis pegala*									G5/SNR									
Small Wood Nymph *Cerbyonis oetus*									G5/SNR									
Common ringlet *Coenonympha tullia*									G5/SNR									
Monarch *Danaus plexippus*									G5/SNR									
Common Checkered Skipper *Pyrgus communis*									G5/SNR									
Juba Skipper *Hesperia juba*									G5/SNR									
Draco Skipper *Polites draco*									G5/SNR									
Woodland Skipper *Ochlodes sylvanoides*									G5/SNR									

Species	Refuge Purpose Species	Species Abundance	Breeds/Nests Locally	BIDEH	Federal T&E	Birds of Conservation Concern- USFWS R1& BCR 9 and 10	ID Partners in Flight High Priority Species	ID Partners in Flight Mod Priority Species	Idaho Comprehensive Wildlife Conservation Plan Species of Greatest Conservation Need	Intermountain West Regional Shorebird Plan Regionally Important Species	Intermountain West Waterbird Conservation Plan	Intermountain West Coordinated Implementation Plan	N.A. Waterbird Conservation Plan	N.A. Waterfowl Management Plan BCR 9 Breeding/Non-Breeding Need	USFWS Idaho Partners for Fish and Wildlife Program	Conservation Strategy for Southeastern Idaho Wetlands	BLM Sensitive Species	TNC Ecoregional Conservation Plan
Dragonflies																		
Spotted Spreadwing *Lestes congener*									G5/SNR									
Boreal Bluet *Enallagma boreale*																		
Tule Bluet *Enallagma carunculatum*									G5/SNR									
Pacific Forktail *Ischnura cervula*									G5/SNR									
Black-fronted Forktail *Ischnura denticollis*									G5/SNR									
Paddle-tailed Darner *Aeshna palmata*									G5/SNR									
Variable Darner *Aeshna interrupta*									G5/SNR									
Western Meadowhawk *Sympetrum occidentale*																		
Black Meadowhawk *Sympetrum danae*																		
Cherry-faced																		

Species	**Refuge Purpose Species**	**Species Abundance**	**Breeds/Nests Locally**	**BIDEH**	**Federal T&E**	**Birds of Conservation Concern-USFWS R1& BCR 9 and 10**	**ID Partners in Flight High Priority Species**	**ID Partners in Flight Mod Priority Species**	**Idaho Comprehensive Wildlife Conservation Plan Species of Greatest Conservation Need**	**Intermountain West Regional Shorebird Plan Regionally Important Species**	**Intermountain West Waterbird Conservation Plan**	**Intermountain West Coordinated Implementation Plan**	**N.A. Waterbird Conservation Plan**	**N.A. Waterfowl Management Plan BCR 9 Breeding/Non-Breeding Need**	**USFWS Idaho Partners for Fish and Wildlife Program**	**Conservation Strategy for Southeastern Idaho Wetlands**	**BLM Sensitive Species**	**TNC Ecoregional Conservation Plan**
Meadowhawk *Sympetrum internum*																		
Variegated Meadowhawk *Sympetrum corruptum*																		
Striped Meadowhawk *Sympetrum pallipes*																		

Table E-2 Key

Species Abundance:
Season
Sp = Spring
S = Summer
F = Fall
W = Winter
Occurs:
a = Abundant: a common species which is very numerous
c = Common: certain to be seen in suitable habitat
u = Uncommon: present, but not certain to be seen
o = Occasional: seen only a few times during season
r = Rare: known to be present, but not every year

BIDEH:
x = Species significantly contributes to refuge Biological Diversity, Integrity, and Environmental Health

Federal T&E Species:
FE = Fed. Endangered
FT = Fed. Threatened
FC = Fed. Candidate
FCo = Fed. Spec. of Concern

Birds of Conservation Concern
R1 = USFWS Region 1 (WA, OR, ID)
9 = Great Basin Bird Conservation Region (BCR 9)
10 = Northern Rockies Bird Conservation Region (BCR 10)

ID Partners in Flight (PIF):
Number (e.g., 24): Total PIF species score
(ID) = Statewide
(80) = Basin and Range Physiographic Area
(64) = Central Rocky Mtns Physiographic Area
High Priority = Focal species whose total PIF score $\geq$ 22, or total score 18-21 and Area of Importance + Population Trend $\geq$ 8
* = Species that are habitat specialists

State Wildlife Action Plan: Identified by plan as Species of Greatest Conservation Needs.
GX or SX = Presumed extinct or extirpated: not located despite intensive searches and virtually no likelihood of rediscovery.
GH or SH = Possibly extinct or extirpated (historical): historically occurred, but may be rediscovered.
G1 or S1= Critically imperiled: at high risk because of extreme rarity (often 5 or fewer occurrences), rapidly declining numbers, or other factors that make it particularly vulnerable to rangewide extinction or extirpation.
G2 or S2 = Imperiled: at risk because of restricted range, few populations (often 20 or fewer), rapidly declining numbers, or other factors that make it vulnerable to rangewide extinction or extirpation.
G3 or S3 = Vulnerable: at moderate risk because of restricted range, relatively few populations (often 80 or fewer), recent and widespread declines, or other factors that make it vulnerable to rangewide extinction or extirpation.

G4 or S4 = Apparently secure: uncommon but not rare; some cause for long-term concern due to declines or other factors.
G5 or S5 Secure = common, widespread, and abundant.
N = Nonbreeding Conservation status refers to the non-breeding population of the species.
B = Breeding population of the species
N = Non-breeding population of the species
M = Migrant species occurring regularly on migration at particular staging areas or concentration spots where the species might warrant conservation attention.
SRB = Within Snake River Bassalt Section of Idaho Comprehensive Wildlife Conservation Strategy
Priority species in priority habitat of the Camas Section is indicated by:
A = Arable land (Agriculture)
Seeded Perennial Grassland
Disturbed and Invasive Grass and Forb
NNH = Non-Native Herbaceuous
SXS = Southern Xeric Shrubland and Steppe
Inter-Mountain Basins Big Sagebrush Shrubland
Inter-Mountain Basins Mixed Salt Desert Scrub
Columbia Plateau Low Sagebrush Steppe
Columbia Plateau Steppe and Grassland
Inter-Mountain Basins Big Sagebrush Steppe
Inter-Mountain Basins Montane Sagebrush Steppe
Inter-Mountain Basins Semi-Desert Shrub-Steppe
Rocky Mountain Lower Montane Riparian Woodland and Shrubland (Key Ecological Section)
DCR = Dune, Canyon, and Rockland

Intermountain West Regional Shorebird Plan:
Regional Priorities = Very High, High, Moderate, Low, Non-Priority
First Number (i.e., x/) = Great Basin Bird Conservation Region (BCR 9)
Second Number (i.e., /x) = Northern Rockies Bird Conservation Region (BCR 10)

Intermountain Regional Shorebird Plan: 1 = no risk; 5 = highly imperiled
Moderate Priority = Not high priority species, but should be considered in habitat management or monitoring plans

Intermountain West Waterbird Conservation Plan:
Regional Priorities = High, Moderate
9 = Great Basin Bird Conservation Region (BCR 9)
10 = Northern Rockies Bird Conservation Region (BCR 10)

BLM Sensitive Species
The column titled “USDI Bureau of Land Management” indicates designations assigned by that agency. National policy directs state directors to designate BLM sensitive species in cooperation with the state fish and wildlife agency (BLM manual 6840). The Idaho State BLM Office updated these designations in 2003. The sensitive species designation is normally used for species that occur on BLM public lands and for which BLM has the capability to significantly affect the conservation status of the species through management.

Type 1: Threatened, endangered, proposed, and candidate: species listed by the FWS or NMFS as threatened or endangered, or proposed or candidates for listing under the Endangered Species Act of 1973.

Type 2: Rangewide/Globally imperiled: species that are experiencing significant declines throughout their range with a high likelihood of being listed in the foreseeable future due to their rarity and/or significant endangerment factors. This includes species ranked by the NatureServe heritage program network with a Global rank of G1-G3 or T1-T3 or recent data indicate that the species is at significant rangewide risk and this is not currently reflected by heritage program global ranks.

Type 3: Regional/State imperiled: species that are experiencing significant declines in population or habitat and are in danger of regional or local extinctions in Idaho in the foreseeable future if factors contributing to their decline continues. This includes Idaho BLM sensitive species that (a) are not in Type 2, (b) have an S1 or S2 State rank (exception being a peripheral or disjunct species), or (c) score high (18 or greater) using the Criteria for Evaluating Animals for Sensitive Species Status or (d) other regional/national status evaluations (e.g., Partners in Flight scores) indicate significant declines.

Type 4: Peripheral: species that are generally rare in Idaho with the majority of their breeding range largely outside the State (Idaho Conservation Data Center 1994). This includes sensitive species that have an S1 or S2 State ranking, but are peripheral species to Idaho.

Type 5: Watch list: these species are not considered BLM sensitive species and associated sensitive species policy guidance does not apply. Watch list species include species that may be added to the sensitive species list depending on new information concerning threats, species' biology or statewide trends. The Watch List includes species with insufficient data on population or habitat trends or the threats are poorly understood. However, there are indications that these species may warrant special status species designation and appropriate inventory or research efforts should be a management priority.

TNC Columbia Platue Ecoregional Conservation Plan
x = Priority species

Table E-3. Plant species at Camas Refuge

Family	Scientific Name	Authority	Common Name
Alismataceae	*Sagittaria cuneata*	Sheldon	Arum-leaved arrowhead
Araceae	*Typha latifolia*	L.	Broadleaf Cattail
Cyperaceae	*Carex aquatilis*	Wahlemb.	Water sedge
Cyperaceae	*Carex athrostachya*	Olney	Slenderbeak sedge
Cyperaceae	*Carex douglasii*	Boott.	Douglas' sedge
Cyperaceae	*Carex filifolia*	Nutt.	Threadleaf sedge
Cyperaceae	*Carex nebrascensis*	Dewey	Nebraska sedge
Cyperaceae	*Carex rostrata*	Stokes ex With.	Beaked sedge
Cyperaceae	*Eleocharis pauciflora*	(Lightf.) Link	Fewflower spikerush
Cyperaceae	*Eleocharis rostellata*	(Torr.) Torr.	Beaked spikerush
Cyperaceae	*Scirpus acutus*	Muhl. Ex Bigel.	Hardstem bulrush
Cyperaceae	*Scirpus americanus*	Pers.	American bulrush
Cyperaceae	*Scirpus pumilus*	Vahl.	Common threesquare bulrush
Equisetaceae	*Equisetum arvense*	L.	Field horsetail
Equisetaceae	*Equisetum laevigatum*	A. Braun	Smooth scouring rush
Gramineae	*Agropyron cristatum*	(L.) Gaertn.	Crested Wheatgrass
Gramineae	*Agropyron dasytachyum*	(Hook.) Scribn.	Thickspike Wheatgrass
Gramineae	*Agropyron elongata*	(Host) Beauv.	Tall Wheatgrass
Gramineae	*Agropyron riparium*	(Scribn. and Smith) Bowden	Streambank Wheatgrass
Gramineae	*Agropyron smithii*	Rydb.	Western Wheatgrass
Gramineae	*Alopecurus pratensis*	L.	Meadow Foxtail
Gramineae	*Bromus inermis*	Leysser	Smooth Bromegrass
Gramineae	*Bromus tectorum*	L.	Cheatgrass
Gramineae	*Distichlis stricta*	(Torr.) Rydb.	Inland saltgrass
Gramineae	*Elymus cinereus*	Scribn. and Merr.	Basin Wildrye
Gramineae	*Elymus flavescens*	Scribn. and Smith	Yellow Wildrye

Family	Scientific Name	Authority	Common Name
Gramineae	*Elymus repens*	(L.) Beauv.	Quackgrass
Gramineae	*Hordeum jubatum*	L.	Foxtail Barley
Gramineae	*Koeleria nitida*	Nutt.	Prairie Junegrass
Gramineae	*Muhlenbergia asperifolia*	(Nees and Meyen) L.R. Parodi	Alkali/Scratchgrass Muhly
Gramineae	*Oryzopsis hymenoides*	(Roem. and Schult.) Bark.	Indian Ricegrass
Gramineae	*Phalaris arundinacea*	L.	Reed Canarygrass
Gramineae	*Poa juncifolia*	Scribn.	Alkali Bluegrass
Gramineae	*Poa nevadensis*	Vasey ex Scribn.	Nevada Bluegrass
Gramineae	*Poa pratensis*	L.	Kentucky Bluegrass
Gramineae	*Poa sandbergii*	Vasey	Sandberg Bluegrass
Gramineae	*Poa trivialis*	L.	Rough Bluegrass
Gramineae	*Sitanion hystrix*	(Nutt.) Smith	Squirreltail
Gramineae	*Sporobolus airoides*	(Torr.) Torr.	Alkali Sacaton
Gramineae	*Sporobolus cryptandrus*	(Torr.) A. Gray	Sand Dropseed
Gramineae	*Stipa comata*	Trin. and Rupr.	Needle and Thread
Gramineae	*Stipa thurberiana*	Piper	Thurber Needlegrass
Gramineae	*Agropyron caninum*		Slender Wheatgrass
Gramineae	*Agropyron spicatum*	(Pursh) Scribn. and Smith	Bluebunch Wheatgrass
Gramineae	*Agrostisgigantea*	Roth	Redtop
Gramineae	*Calamagrostis canadensis*	(Michx.) P. Beauv.	Bluejoint Reedgrass
Gramineae	*Deschampsia cespitosa*	L.	Tufted Hairgrass
Gramineae	*Elymus triticoides*	Buckley	Creeping Wildrye
Gramineae	*Phleum pratense*	L.	Timothy
Gramineae	*Poa palustris*	L.	Fowl Bluegrass
Gramineae	*Spartina gracilis*	Trin.	Alkali cordgrass
Juncaceae	*Juncus balticus*	Willd.	Baltic rush
Juncaceae	*Luzula campestris*	(L.) DC.	Field Woodrush
Juncaceae	*Luzula paruiflora*	(Ehrh.) Desvaux	Millet Woodrush

Family	Scientific Name	Authority	Common Name
Juncaginaceae	*Triglochin palustre*	L.	Arrowgrass
Juncaginaceae	*Triglochin maritimum*	L.	Arrowgrass
Marsileaceae	*Marsilea vestita*	Hook and Grev.	Pepperwort; Coverfern
Poaceae	*Polypogon monspeliensis*	(L.) Desf.	Rabbitfoot Grass
Poaceae	*Trisetum*	Pers.	Oatgrass, Trisetum
Poaceae	*Panicum capillare*	L.	Witchgrass
Forbs			
Amaranthaceae	*Amaranthus blitoides*	S. Wats.	Mat Amaranth
Amaranthaceae	*Amaranthus californicus*	(Moq.) Wats.	California Amaranth
Amaranthaceae	*Amaranthus powellii*	Wats.	Powell's Amaranth, Pigweed
Asclepiadaceae	*Asclepias speciosa*	Torr.	Showy Milkweed
Asteraceae	*Achillea millefolium*	L.	Yarrow
Asteraceae	*Ambrosia* sp.	L.	Ragweed
Asteraceae	*Ambrosia acanthicarpa*	Hook.	Ragweed, Annual Bursage
Asteraceae	*Artemisia absinthium*	L.	Common Sagewort
Asteraceae	*Artemisia ludoviciana*	Nutt.	Louisiana Sagewort
Asteraceae	*Aster foliaceus*		Aster
Asteraceae	*Balsamorhiza sagittata*		Arrowleaf Balsamroot
Asteraceae	*Carduus nutans*	L.	Musk/nodding Thistle
Asteraceae	*Centaurea diffusa*	Lam.	Diffuse Knapweed
Asteraceae	*Centaurea repens*	L.	Russian Knapweed
Asteraceae	*Chaenactis douglasii*	Hook. & Arn.	Douglas' Dustymaiden
Asteraceae	*Chondrilla juncea*	L.	Rush Skeletonweed
Asteraceae	*Cirsium arvense*	(L.) Scop.	Canada Thistle
Asteraceae	*Cirsium vulgare*	(Savi) Tenore	Bull Thistle
Asteraceae	*Grindelia squarrosa*		Curlycup Gumweed
Asteraceae	*Helenium autumnale*	L.	Sneezeweed
Asteraceae	*Helianthus annuus*	L.	Common Sunflower
Asteraceae	*Iva axillaris*		Sumpweed, Povertyweed
Asteraceae	*Iva xanthifolia*	Nutt.	Sumpweed, Marshelder
Asteraceae	*Lactuca serriola*		Prickly Lettuce
Asteraceae	*Lactuca tatarica*	(L.) C.A. Mey.	Blue Lettuce

Family	Scientific Name	Authority	Common Name
Asteraceae	*Lygodesmia juncea(?)*		Rush Skeletonplant
Asteraceae	*Lygodesmia spinosa*	Nutt.	Thorn Skeletonweed
Asteraceae	*Machaeranthera canescens*		Sticky Aster/Hoary Aster
Asteraceae	*Onopordum acanthium*	L.	Scotch Cottonthistle
Asteraceae	*Rudbeckia occidentalis*		Western Coneflower
Asteraceae	*Senecio integerrimus*	Nutt.	Lambstongue Ragwort
Asteraceae	*Senecio hydrophilus*	Nutt.	Water Ragwort
Asteraceae	*Senecio serra*	Hook.	Tall Ragwort
Asteraceae	*Senecio cymbalarioides*	H. Buek	Rocky Mtn. Groundsel, Fewleaf Groundsel
Asteraceae	*Solidago canadensis*	L.	Goldenrod
Asteraceae	*Solidago mutiradiata*	Aiton	Goldenrod
Asteraceae	*Sonchus arvensis*	L.	Marsh Sowthistle
Asteraceae	*Symphyotrichum* species?		Purple Aster
Asteraceae	*Taraxacum* species	Wigg.	Common Dandelion
Asteraceae	*Tragopogon dubius*	Scop.	Salsify
Asteraceae	*Xanthium strumarium*	L.	Common Cocklebur
Boraginaceae	*Amsinckia lycopsoides*	Lehm.	Tarweed
Boraginaceae	*Cryptantha circumscissa*	(Hook and Arn.) John.	Cushion Cryptantha
Boraginaceae	*Cryptantha speculifera*	(Piper) Payson	Snake River Cryptantha
Boraginaceae	*Lappula* species	(Hornem.) Greene	Stickseed
Boraginaceae	*Tiquilia nuttallii*	(Hook) Rich	Nuttall's Crinklemat
Brassicaceae	*Alyssum alyssoides*	L.	Pale Madwort
Brassicaceae	*Brassica niger*	(L.) Koch	Black Mustard
Brassicaceae	*Camelina microcarpa*	Andrz. Ex DC.	Littlepod False Flax
Cactaceae	*Opuntia polyacantha*	Haw.	Prickly Pear Cactus
Capparidaceae	*Cleome lutea*		Yellow Beeplant
Capparidaceae	*Cleome serrulata*		Rocky Mountain Beeplant
Chenopodiaceae	*Chenopodium album*		Lambsquarters
Chenopodiaceae	*Chenopodium leptophyllum*	(Moq.) Wats.	Narrowleaf Goosefoot
Chenopodiaceae	*Halogeton glomeratus*	Meyer	Saltlover
Chenopodiaceae	*Kochia scoparia*	(L.) Schrad.	Kochia, Summer Cypress
Chenopodiaceae	*Salsola kali*		Russian Thistle
Chenopodiaceae	*Suaeda* sp.		Seepseed, Sea Blight

Family	Scientific Name	Authority	Common Name
Convolvulaceae	*Convolulus arvensis*	L.	Field Bindweed
Cruciferae	*Armoracia rusticana*	(Gaertn.) Mey et Scherb.	Wild Horseradish
Cruciferae	*Capsella bursa-pastoris*	(L.) Medic.	Shepherds Purse
Cruciferae	*Descurainia sophia*	(L.) Webb ex Prantl	Herb Sophia
Cruciferae	*Erysimum cheiranthoides*	L.	Prairie Rocket
Cruciferae	*Lepidium perfoliatum*	L.	Clasping Peppergrass
Cruciferae	*Rorippa* species		Yellowcress
Cruciferae	*Sisymbrium altissimum*	L.	Tall Tumblemustard
Cruciferae	*Stanleya species*	L.	Prince’s Plume
Cruciferae	*Thlaspi arvense*	L.	Fanweed/Field Pennycress
Cuscutaceae	*Convolvalus sepium*		Hedge Bindweed
Euphorbiaceae	*Chamaesyce species*	Gray	Sandmat
Hippuridaceae	*Hippuris vulgaris*	L.	Common Mare’s-tail
Hydrophyllaceae	*Phacelia hastata*	Dougl. Ex Lehm	Cordilleran Phacelia
Lamiaceae	*Leonurus cardiaca*	L.	Motherwort
Lamiaceae	*Lycopus americanus*	Muhl. Ex W. Barton	Bugleweed, Water-horehound
Lamiaceae	*Mentha arvensis*	L.	Field Mint
Lamiaceae	*Physostegia parviflora*	Nutt. Ex A. Gray	Western False Dragonhead
Lamiaceae	*Scutellaria galericulata*	L.	Skullcap
Lamiaceae	*Stachys palustris*	L.	Hedge-nettle
Leguminosae	*Astragalus* species		Milkvetch
Leguminosae	*Astragalus calycosus*	Torr. Ex Wats.	Torrey’s Milkvetch
Leguminosae	*Astragalus ceramicus*	Barneby	Painted Milkvetch
Leguminosae	*Astragalus geyeri*	A. Gray	Geyer’s Milkvetch
Leguminosae	*Astragalus lentiginosus*	(Howell) Barneby	Freckled Milkvetch, Salty Loco Milkvetch
Leguminosae	*Glycyrrhiza lepidota*		Wild Licorice
Leguminosae	*Lupinus pusillus*	(Heller) C.P. Smith	Rusty Lupine, Small Lupine
Leguminosae	*Medicago sativa*	L.	Alfalfa
Leguminosae	*Meliotus alba*		Sweetclover
Leguminosae	*Psoralea lanceolata*	(Pursh) Rydb.	Lance-leaved Scurf-pea
Leguminosae	*Sphaerophysa salsula*	(Pallus) D.C.	Alkali Swainsonpea
Leguminosae	*Trifolium pratense*	L.	Red clover
Leguminosae	*Vicia amurensis*	Muhl. Ex Willd.	Vetch, Tare

Family	Scientific Name	Authority	Common Name
Leguminosae	*Vicia* species	L.	Vetch, Tare
Liliaceae	*Allium textile*	Nels and Macbr.	Textile Onion
Liliaceae	*Calochortus brunequnis*	Nels and Macbr.	Sego Lily
Liliaceae	*Maianthemum stellatum*	L.	Star-flowered Solomons seal
Loasaceae	*Mentzelia albicaulis*	(Hook.) Torr. and A. Gray	Whitestem Blazing Star
Maluaceae	*Sphaeralcea coccinea*	(Nutt.) Rydb	Globemallow
Maluaceae	*Sphaeralcia munroana*	(Dougals) Spach	Munro’s Globemallow
Nyctaginaceae	*Abronia* species	Juss.	Sand Verbena
Onagraceae	*Epilobium angustifolium*	L.	Fireweed, Great Willowherb
Onagraceae	*Epilobium* species	L.	Willow-herb
Onagraceae	*Gayophytum* species	Torr. and A. Gray	Groundsmoke
Onagraceae	*Oenothera* species		Evening Primrose
Onagraceae	*Oenothera pallida*	Lindl.	Pale Evening Primrose
Orobanchaceae	*Castilleja angustifolia*	(Nutt.) G. Don	Northwestern Indian Paintbrush
Orobanchaceae	*Orobanche* species	Nutt.	Broomrape
Plantaginaceae	*Plantago patagonica*	Jacq.	Wooly Plantain
Plantaginaceae	*Plantago* species	L.	Plantain
Polemoniaceae	*Eriastrum sparsiflorum*	(Eastw.) H. Mason	Great Basin Woolystar
Polemoniaceae	*Phlox hoodii*	Richardson	Hoods/Carpet Phlox
Polygonaceae	*Eriogonum cernuum*	Nutt.	Nodding Buckwheat, Antlerweed
Polygonaceae	*Eriogonum microthecum*	Nutt.	Slender Buckwheat
Polygonaceae	*Eriogonum ovalifolium*	Nutt.	Oval-leaf Desert Buckwheat
Polygonaceae	*Persicaria lapathifolium*	L.	Pale Smartweed
Polygonaceae	*Polygonum amphibium*	(L.) Cole.	Water Smartweed
Polygonaceae	*Polygonum aviculare*	L.	Prostrate Knotweed
Polygonaceae	*Polygonum douglasii*	(Greene) Bull	Douglas’ Knotweed
Polygonaceae	*Rumex venosus*	Pursh.	Sand Dock
Polygonaceae	*Rumex crispus*	L.	Curly Dock
Portulacaceae	*Portulaca oleracea*	L.	Purslane, Kiss-me-quick
Rosaceae	*Potentilla anserina*	L.	Silverweed
Rosaceae	*Potentilla* species	L.	Cinquefoil
Santalaceae	*Comandra umbellata*	Nutt.	Bastard Toadflax
Scrophulariaceae	*Verbascum thapsus*	L.	Common Mullein

Family	Scientific Name	Authority	Common Name
Scrophulariaceae	*Veronica catebata*	Pennell	Chain Speedwell
Solanaceae	*Solanum dulcamara*	L.	Bittersweet Nightshade
Solanaceae	*Hyoscyamus niger*	L.	Black Henbane
Urticaceae	*Urtica dioica*	L.	Stinging Nettle
Verbenaceae	*Verbena bracteata*	Lag. and J. D. Rodr	Prostrate Vervain
Verbenaceae	*Verbena hastata*	L.	Blue Vervain, Swamp Verbena
Trees and Shrubs			
Anacardiaceae	*Rhus trilobata*	Nutt.	Skunkbush Sumac
Asteraceae	*Artemisia tripartita*	Rydb.	Threetip Sagebrush
Asteraceae	*Artemisia tridentata*	Nutt.	Big Sagebrush
Asteraceae	*Artemisia tridentata wyomingensis*	(Beetle and Young) Welsh	Wyoming Big Sagebrush
Asteraceae	*Chrysothamnus nauseosa*	(Pall.) Britton	Common/Gray Rabbitbrush
Asteraceae	*Chrysothamnus viscidiflorus*	(Hook) Nutt.	Green Rabbitbrush
Asteraceae	*Gutierrezia sarothrae*	(Pursh) Britton and Rusby	Broom Snakeweed
Asteraceae	*Tetradymia canescens*	DC.	Gray/Common Horse-brush
Chenopodiaceae	*Atriplex canescens*	(Pursh) Nutt.	Fourwing Saltbrush
Chenopodiaceae	*Eurotia lanata*	(Pursh) Meeu. and Smit	Winterfat
Chenopodiaceae	*Grayia spinosa*	(Hook) Moq.	Spiny Hopsage
Cupressaceae	*Juniperus osteosperma*	(Torr.) Little	Utah Juniper
Cupressaceae	*Juniperus scopulorum*	Sarg.	Rocky Mountain Juniper
Elaeagnaceae	*Elaeagnus commutata*	Bebb.	Wolfwillow, Silverberry
Elaeagnaceae	*Elaeagnus angustifolia*	L.	Russian Olive
Elaeagnaceae	*Shepherdia argentea*	(Pursh) Nutt.	Silver Buffaloberry
Grossulariaceae	*Ribes aureum*	Pursh.	Golden Currant
Oleaceae	*Fraxinus* sp.	L.	Ash
Papilionaceae	*Caragana arborescens*		Siberian Pea
Pinaceae	*Pinus sylvestris*	L.	Scotch Pine
Polygonaceae	*Eriogonum heracleoides*		Buckwheat
Rosaceae	*Crataegus* sp.	Tourn. Ex L.	Hawthorn
Rosaceae	*Dasiphora fruitcosa*	(L.) Rydb	Shrubby Cimquefoil
Rosaceae	*Prunus* sp.	L.	Plum
Rosaceae	*Prunus virginiana*	L.	Chokecherry
Rosaceae	*Purshia tridentata*	(Pursh) D.C.	Antelope Bitterbrush

Family	Scientific Name	Authority	Common Name
Rosaceae	*Rosa woodsii*	Lindl.	Woods Rose
Salicaceae	*Populus deltoides*	Marsh.	Plains Cottonwood
Salicaceae	*Populus fremontii*	Wats.	Fremont Cottonwood
Salicaceae	*Populus trichocarpa*	T. and G.	Black Cottonwood
Salicaceae	*Salix amygdaloides*	Andress.	Peachleaf Willow
Saliaceae	*Salix exigua*	Nutt.	Narrowleaf Willow, Coyote Willow
Salicaceae	*Salix lucida*		Pacific/Greenleaf Willow, Whiplash Willow
Salicaceae	*Salix lutea*	Nutt.	Yellow Willow
Sapindaceae	*Acer negundo*	L.	Box Elder
Sarcobataceae	*Sarcobatus vermiculatus*	(Hook.) Torr.	Black Greasewood

E.2 Biological Integrity, Biological Diversity, and Environmental Health

E.2.1 Biological Integrity, Biological Diversity, and Environmental Health

Habitats or plant communities should be considered resources of concern when they are specifically identified in refuge purposes, support species or species groups identified in refuge purposes, support FWS trust resources, are indicative of the ecological (internal factors responsible for refuge habitats [nutrient cycling, hydrology, soils]) or ecosystem (external drivers [watershed variables, climate change]) processes within the refuge and surrounding landscape, and/or are important in the maintenance or restoration of biological integrity, diversity, and environmental health.

By policy, the Service plans for the maintenance and restoration of refuge resources by managing for biological integrity, biological diversity, and environmental health (601 FW 3). According to the policy, the highest measure of biological integrity, biological diversity, and environmental health is viewed as those intact and self-sustaining habitats and wildlife populations that existed during historic conditions. The Service policy focuses on these three distinct yet largely overlapping concepts of biological integrity, diversity, and environmental health, with a core philosophy of maintaining composition and function of ecosystems (Fischman 2004). Biological integrity, diversity, and environmental health lie along a continuum from a biological system extensively altered by significant human impacts to a completely natural system. While refuge habitats are not expected to retain or establish absolute integrity, diversity, and health, the policy directs managers to plan for the maintenance and restoration of biological integrity, diversity and environmental health while considering all three in an “integrated and holistic manner”.

Because there is a wide diversity of species and habitats within the Camas ecosystem, the approach to habitat management considers the historic, current, and the potential complex array of conditions and constraints associated with Camas NWR. The primary focus of this plan is to provide management strategies and prescriptions to achieve habitat objectives that consider the habitat requirements for resources of concern. The Camas NWR CCP will foster management goals based on an emphasis in improving environmental sustainability and objective driven actions that protect and restore the processes responsible for ecological integrity at various spatiotemporal scales.

Table E-4. Habitat and Ecosystem Associations at Camas Refuge

Hemi Marsh <u>Habitat sub-types</u> • Open water • Submerged aquatic plants • Deep emergent (bulrush/cattail)	The hemi-marsh is comprised of open water, submerged aquatics, and deep emergent vegetation. Open water habitat is vital to providing piscivore access to refuge fish in wetland habitats and maintaining open stream channels While not as essential as submergent habitat is, open water is important to maintain for a select few species which require open water habitat for their existence. Submergent vegetation is the most widely used, yet least abundant palustrine emergent habitat type on the Refuge. Providing leafy browse for grazing species, seeds for granivorous species, and invertebrate resources for molting, nesting, and young waterbirds, it provides the food reserve function within the hemi-marsh system. Deep emergent vegetation (bulrush and cattail) at varying levels of residual coverage, provide nesting habitat and cover for a variety of wetland-dependent wildlife species. Deep emergent vegetation provides overwater nesting sites for wetland-dependent bird species; invertebrate substrate for foraging waterbirds and fish; lodge materials and loafing sites for aquatic mammals, as well as providing shade and cover for all species, emergent vegetation forms the “housing” requirement within the hemi-marsh environment.	Open water and habitats are located very low in the landscape with a perennially flooded hydroperiod and deep flooding depths (>36") through the growing season. Submerged aquatic vegetation occurs in permanently flooded wetlands >6" and <36" deep and requires high water clarity for germination and photosynthesis. Deep emergent vegetation is a byproduct of a permanent or semi-permanent hydroperiod and deep flooding depth (24-40") or saturated soils during the growing season. Naturally occurring open water habitat within the marsh is a primary byproduct of hydroperiod and herbivory. Sustained high water increases sedimentation and decreases water clarity and submerged aquatic vegetation germination rates, thereby increasing open water habitat. Inversely, natural drought decreases inundation of deep water habitats, stimulating increases in submerged aquatic germination and decreasing the availability of open water areas. Tall emergent vegetation efficiently removes nitrates by providing higher amounts of organic substrate for denitrifying bacteria and limiting sunlight from the water column, promoting anaerobic conditions for denitrification.	Groundwater depletion or lowering of shallow aquifer groundwater leading to groundwater recharge and a modified (shortened) seasonal wetland hydroperiod; decreased artesian groundwater flows; drought cycles (current 8-year); loss or shortened perennial surface flows in Camas Creek; pumping costs, groundwater pumping rights; surface water water right protection and enforcement; Unnatural sustained low hydroperiod in wetland units create significant sediment or peat accumulation, encroachment and expansion of bulrush/cattail, or annual winter freezing to marsh substrate, and lead to reduced over-winter muskrat survival. Sedimentation and reduced germination of submerged aquatic forage can be caused by excessive natural herbivory (waterbirds), disturbance and trampling from administrative or recreational boating and/or hunting, or invasive species introductions (Eurasian milfoil).

Shallow Marsh <u>Habitat sub-types</u> • Cattail (small islands) • Sedge • Baltic rush	Shallow emergent habitat type contains plant species such as alkali bulrush and annual weedy plants which provide an additional food reserve function within the hemi-marsh complex. Typically, deep emergent vegetation forms as a concentric ring around open water/submergent habitats, while shallow emergent vegetation provides the interface with the ephemeral wet meadow zone. As such, the shallow emergent zone functions similarly to the deep emergent zone for those wetland-dependent wildlife species that require wet meadow and adjacent uplands to fulfill their life history strategies.	Semi-permanently to ephemerally flooded habitat typically flooded to a depth of 3"-24". The primary difference in processes between deep and shallow emergent habitat is water permanence. Shallow emergent vegetation is similar to deep emergent vegetation except that depths within this zone are typically shallower resulting in less permanency. Shallow emergent habitats are occasionally dewatered during summer months (semi-permanent), while deep emergent habitats are permanently flooded year-long.	Topographic profile of current wetland impoundments favors deep Hemi-marsh habitats and only allows for a narrow degree of zonation for shallow marsh establishment. Little or no connectivity occurs from shallow marsh to wet meadow habitats. Shortened or reduced hydroperiods now occur within shallow marsh, due to groundwater depletion and the lowering of the groundwater table.
Wet-Meadow <u>Habitat sub-types</u> • Rushes • Water tolerant grasses and forbs • Alkali grasses	Ranging from moist soil during late summer to >2 feet of water during spring, it is this seasonal fluctuation that produces and then concentrates food reserves for most wetland-dependent wildlife species. The diversity and complexity of plant species within ephemeral marsh habitats provides ideal substrate for invertebrates which comprise 90% of most waterbird diets during summer months; however, with fall flooding during migration, the annual seeds produced by these plants additionally provide forage for migratory waterbirds as well. Alkali habitat can be less diverse than wet meadow habitats and typically less canopy coverage, the low stature, open nature of this habitat type lends itself to migration use by waterfowl and shorebirds, as well as nesting/brood rearing habitat for shorebird species such as the American avocet and long-billed curlew.	Ephemeral hydroperiod (April-July) with a moderate flooding depth (6-30"). Located in soils that are moist to saturated during the growing season. Typically holds surface water through late summer, with only isolated micro-depressions or sloughs holding water into the early fall. Typically only holds surface water till late Spring, but may be receive no surface flooding in very dry years. Wet meadow habitats may contain small patches or large flats of alkali meadows. Alkali meadow habitat differs from wet meadow s primarily by the quality of water typically hydrating the marsh. Where freshwater (<1,000 ppm TDS) input is the norm, wet meadow plants become established. Water sources >1,000 ppm TDS or where hydrology has favored natural evaporative areas over time, tend to foster more specialized group of plants known as halophytes become established through successive years.	Conversion to haying or agriculture, surface water diversion, groundwater depletion or lowering of shallow aquifer groundwater leading to groundwater recharge and a modified (shortened) seasonal wetland hydroperiod; invasive species, climate change, extreme drought or flood conditions; grazing; development; invasive species; agricultural byproducts and pesticide accumulation.

Dry Meadow <u>Habitat sub-types</u> • Upland grasses and forbs • Alkali upland grasses	Both dry meadow and alkali dry meadow habitats typically have grasses normally occurring in upland, i.e., higher elevation, sites, characterizing their respective vegetative communities. Typically, dry meadow grass species are taller in stature and have considerably more structural complexity than alkali dry meadow grasses and are, therefore, used by a wider range of wildlife species. Dry meadows are comprised of native grass species such as Great Basin wildrye and tall wheatgrass. Alkali dry meadow grasslands are characterized by such species as western saltgrass. Alkali dry meadows are an uncommon habitat located in isolated shallow pans; probably flooded in spring. Often has a salt crust in summer, sparsely vegetated with patches of bare soil. Dry Meadows provide a vital nesting area for sensitive species such as American avocet and long-billed curlew. The juxtaposition of dry meadow habitats to wet meadows is vitally important to wildlife species. Upland nesting waterfowl and shorebird species such as northern pintail and Wilson's phalarope are just a few of the examples.	Upland habitat differs from wetland habitat processes based on the seasonal periodicity of hydration. Upland habitats can be seasonally flooded to as much as 3, but usually for less than 10 days in the spring. As a type of Dry Meadows are often seasonally flooded in excess of 10 days, but for a shorter period than wet meadow sites. Characterized by pH neutral soils and less dissolved salt, dry meadows can thus support a wider range of plant species can grow than either upland sites, or alkaline dry meadows; the alkaline site having a much higher pH and dissolved salts as a function of a restrictive soil layer, longer hydration, or more saline watershed, or a combination of these characteristics. Similar to the relationship between wet and alkali wet meadows, upland grass distribution in dry and alkali dry meadows varies by soil pH and conductivity as influenced by site specific evaporation rates.	Extreme drought or flood conditions; groundwater depletion; grazing; development; conversion to agriculture; invasive species; fire; grazing; haying.
Sagebrush Steppe <u>Habitat sub-types</u> • Basin big sagebrush • Wyoming big sagebrush • Bitterbrush • Green rabbitbrush • Grasses and forbs • Non-native crested wheatgrass plantings • Cheatgrass	Sagebrush steppe is one of the most critically imperiled habitats in western North America. Various sources estimate up to 99% reduction in some sagebrush species in the Snake River Plain (Noss et al.). This community is dominated by shrubs with an understory of various bunchgrass and forb species found within interspaces. It can be found above greasewood/basin big sagebrush communities on various aspects, slopes, and soil types. Zones of former sagebrush steppe have been supplanted by crested wheatgrass, an exotic perennial bunchgrass widely used conservation plantings	Gradients in soil depth and elevation determine whether basin or Wyoming big sagebrush dominates a site. Bitterbrush is a subcomponent in some sites, but is not a dominant species. Wyoming big sagebrush sites tend to host more diverse and dense forb communities. The Wyoming sites are often characterized by soil sites that are more shallow, sometimes with an increased balsalt constituent, resulting in relatively higher concentrations of available soil moisture. These sage communities	Historic and past grazing practices decreased plant species diversity in many of these areas through overstocking, overuse of forage and improper grazing timing, or scheduling. Improper grazing made sage habitats vulnerable to invasive plants, particularly annual grasses as cheatgrass and knapweed (diffuse and Russian) invasion. Altered fire regimes where invasive plants, particularly cheatgrass, have compromised many stands from recovering naturally from wildfire. These invasive annual grasses and forbs are capable of outcompeting native grasses and forbs in the sage understory. Perennial grass monocultures (crested wheatgrass, brome) have replaced

	across western North America. Cheatgrass is an exotic annual grass that has been expanding throughout western North America. In the Snake River Plain, cheatgrass has been linked to an altered wildfire cycle.	depend on natural fire cycles or equivalent disturbance to maintain a balance between shrub, grass, and forb components. A lack of disturbance lends itself to high shrub densities with sparse vegetation in the interspaces. Conversely, fire at too frequent an interval results in a decline of sagebrush and bitterbrush with a concurrent increase in herbaceous species. Exotic annual grasses and forbs particularly have increased at Camas Refuge under this regime. Crested monocultures have developed at Camas Refuge through in rehabilitation of either retired cropland or wildfire areas. Scattered stands, and crested plants interspersed in other vegetation, have also established through competitive expansion by the crested wheatgrass itself. Cheatgrass phenology features early germination which allows it to establish and outcompete native plants. It is expanding through a variety of channels common to a variety of weed species, but is particularly adapted to high fire frequency intervals. The cheatgrass pioneers into recent burns, increases the highly combustable fine fuel component, thereby predisposing the recent burn site to additional fire the following season.	much of the original Camas Refuge sagebrush steppe after wildfires and farm field retirement. Refuge sagebrush communities tend toward more advanced seral stages. The structure of these sites predisposes many of them to cataspophic wildlife and complete stand replacement.

Riparian <u>Habitat sub-types</u> • Willow woodland • In-stream Aquatic	A locally uncommon and nationally decreasing habitat type found in small but important acreages across the Refuge. Riparian habitats do exist as stands, groves, or clumps, but are generally arrayed as a linear community along stream courses. Riparian rivals the diversity found in wet meadow habitats. Willow overstory and a diverse mix of wet meadow related plant understory make palustrine forested habitats critically important for a variety of migratory and breeding landbird species. Additionally, stream courses such as Camas Creek once provided critical spawning access for cutthroat trout.	Smaller drainages and isolated seeps, typically subject to an ephemeral, spring flooding regime (>0"-12" in depth). The main channel of Camas Creek is subject to estimated average flows of 160-180 cfs. Extreme events estimated at, or above, 200 cfs can occur. These spring flows, or floods, typically last about 2 months, but can persist for as long as 4 months and have been reported as short as 2 weeks.	Legal water right diversions, illegal water diversions, altered streamflows, groundwater depletion-groundwater recharge, grazing and browsing pressure of native ungulates, water quality, beaver removal, seed source, grazing, altered channel morphology (incision and diversion), ditch maintenance (tree/shrub removal and dredging). In terms of the main stream riparian habitats, the long-term trend has been toward drier conditions, resulting in either less water available to Camas Creek riparian communities, or water available for a shorter period of time. Fluvial geomorphology threatened by Camas Creek channel alterations to support off-site irrigation interests.
Shelterbelt <u>Habitat sub-types</u> • Cottonwood gallery • Small trees • Shrubs	The cottonwood gallery comprises a unique habitat complex adjacent to and surrounding the refuge headquarters. The gallery generally follows either natural or manmade waterways. This series of essentially linear woody vegetation communities, ranging from shrubs to mature plains cottonwood (*Populus deltoides*) trees exceeding 100 feet in height, hosts an abundant and diverse fauna, particularly migratory landbirds. This is typical of the matrix habitat effect of cottonwood gallery forests on animal distribution in fragmented landscapes as reported by various authors in several areas. Some of the same researchers have reported the value of relatively open large cottonwood canopies to avifaunal diversity and abundance. Combined with other similar, but usually less diverse, smaller and structurally less intricate, habitat islands on farmsteads and State management areas, the refuge shelterbelt comprises a unique system of oases-like habitats in the upland zone Snake River Plain. Similar habitat, but with native cottonwood, and other, species	Under natural conditions, the species of the shelterbelt community, such as cottonwood, are influenced by dynamic landscape-level processes. Cottonwood spatial and temporal cadences are dependent on typical riverine system environmental gradients, i.e., discrete fluvial discharge with attendant sediment deposition, or from wildfires, usually stand-replacing. These effects particularly tend to precipitate regeneration, partly due to a general seasonal coincidence with cottonwood seed dispersal and with cottonwood regeneration being dependent on moist, bare seedbeds. Peak fluvial discharge and significant alluvial aggredation is not a characteristic of the artificial irrigation system supporting the headquarters' shelterbelt. Lacking episodic floods, the relatively scarce potential seedbeds are usually heavily vegetated and competition intense, at	Water, particularly for cottonwoods that can typically require up to 100 gallons per tree per day, is the single most limiting factor. There is an addition, semi-unique need in cottonwoods for late season moisture; typically into October or early November. (Hoag, USDA, NRCS, ret, pers. comm.). Additional requisites of soil fertilities and chemistries within at least normal bounds are also present. High competition levels with a particularly robust community of exotic, invasive weeds energized by high levels of human surface disturbance relative to a history of intense agricultural activity and attendant structural development. High winds are also characteristic of the local landform which approximates a vast plain and are particularly antithetical to the arboreal form. The Aeolian effect further exacerbates the hot and arid climate in desiccating shrubs and trees, increasing evapotranspiration and escalating moisture demand.

	occurs in the major river corridors of the Snake River Plain. Composition ranges from native shrubs and smaller trees, such as willows and hawthorne, to exotic shrubs and small and large trees, primarily Siberian peashrub, Russian olive and plains cottonwood.	least compared with natural riverine sites. However, both wildfire and prescribed fire are possibilities, although general not as intense. Positive effects of refuge irrigation replacing the descrete pulses of regeneration related to peak river discharges, the headquarters stands generally escape the high sapling mortality due to extreme floods of large river systems. Perhaps most notable is the higher dependability and predicatability of artificial hydration. Additional, the temporal scale of flow events can be controlled to coincide with critical life cycle periods of the stand communities various plant species.	
Agriculture Habitat sub-types • Small Grain (wheat or spring barley) • Summer Fallow • Legumes (Alfalfa)	Agricultural habitats (crop fields) comprise a small percentage of refuge lands but provide fall migratory forage for waterfowl and landbirds. At a point where carbohydrates are required for migration, species such as Canada geese, greater sandhill cranes, and dabbling ducks can find abundant grain to fulfill this life history requirement. Additional benefits are provided for spring/summer grazing by geese and cranes as new growth shoots become available.	N/A	Funding, shortened growing season, and low precipitation, weeds, non-refuge crop depredation, haying obligations. The diverse ungulate population of the Refuge, especially Rocky Mountain elk and white-tailed deer, also use the refuge croplands. Ungulate grazing can limit cropland production available to migratory birds, but the significance of the effect varies annually. Use by the ungulates is also a legitmate application of refuge agricultural production.

E.3 Priority Refuge Resources of Concern and Focal Resources

Focal resources (Table E-6) are a prioritized subset of the Camas NWR Priority Resources of Concern from (Table E-5) and represent legally mandated species and natural communities for management of Camas NWR.

The species selected as priority resources of concern from these plans support the following NWRS mandates:

- Support refuge purposes and the NWRS mission;
- Conserve biological integrity, diversity, and environmental health
- Fulfill FWS trust resource responsibilities (migratory birds, threatened and endangered species, interjurisidicational fish, and marine mammals
- High regional conservation priority

Achieving healthy, functional ecosystems for native fish, wildlife, and plants on the Refuge can be described through the habitat requirements of "focal species" highly associated with important attributes or conditions within habitat types. As described by Altman (2000), the rationale for using focal species is to emphasize habitat attributes most in need of conservation or most essential for functional ecosystems. By managing for a group of species (guild) representative of important components in a functioning ecosystem, the elements of biological integrity, diversity, and environmental health would also be addressed.

E.3.1 Selection of Priority Refuge Resources of Concern

Refuge staff extensively documented and reviewed thirteen regional, flyway, and State plans or lists to classify the conservation status and management priority of Camas NWR fish, wildlife, and plant species (Tables E-2 and E-3). Seven of these plans predominately center on avian species (e.g., birds, shorebirds, waterbirds, waterfowl). Four plans or lists prioritized not only avian species, but all species of great conservation need. Of these four plans, the Idaho Conservation Strategy for Southeast Idaho Wetlands is the narrowest in scope, focusing singularly on wetland habitats. The Idaho Fish and Game Idaho Comprehensive Wildlife Conservation Strategy, priority species list of the USFWS Partners for Fish and Wildlife program, and The Nature Conservancy (TNC) Ecoregional Assessments for the Columbia Plateau identified and ranked the conservation need for a suite of species across multiple habitats.

Subset of Resources of Concern

The list of 292 Resources of Concern (Table E-2) was narrowed down to a smaller subset of for Camas NWR. The subset of Camas NWR Resources of Concern (Table E-5) contains 153 species of the greatest conservation need, including 36 of the 88 species identified in the Snake River Basalts Section of the Idaho Comprehensive Wildlife Conservation Strategy (ICWCS). The 36 ICWCS species that inhabit Camas NWR are comprised of 34 birds, seven mammals, one amphibian, and one reptile. An additional fifteen ICWCS species with State rankings of S1 (Critically Imperiled), S2 (Imperiled), or S3 (Vulnerable) and not identified as Camas Section species of the greatest conservation need and not identified on any other regional conservation plan, but known to inhabit Camas NWR, were added to the refuge subset of Resources of Concern list. Thirty-seven species identified in the TNC Ecoregional Assessments were included in the subset list, as were 20 USFWS

Birds of Conservation Concern from Region 1 (n=12), BCR 9-Great Basin (n=14), and BCR 10-Northern Rockies (n=12). A total of 46 high priority and 34 moderate priority birds from the Idaho Partners in Flight Plan and nine high priority and six moderate priority birds from the Intermountain West Regional Shorebird Plan, were identified for the subset list of Resources of Concern. The subset list also includes 36 BLM sensitive species, comprised of 31 birds, three mammals, one amphibian, and one reptile of Type 1 (one); Type 2 (four); Type 3 (eighteen); Type 4 (one); and Type 5 (twelve) BLM rankings. Fifteen waterfowl species of moderately high or greater breeding or non-breeding priority in BCR 9, as identified in the North America Waterfowl Management Plan, were included in the subset. The Conservation Strategy for Southeastern Idaho Wetlands identified sixteen species-of-concern, including one bird (double-crested cormorant) not found in any other plan or list reviewed. The North America Waterbird Conservation Plan identified one high, nine moderate, and four low priority species of conservation concern that inhabit Camas NWR. Refuge staff also performed an internal assessment of refuge species that contribute significantly to impacting (positively or negatively) the biological integrity, diversity, and environmental health of the Refuge, but are not found in any other conservation plan or list. This assessment yielded nine additional species for the subset list of Resources of Concern for Camas NWR.

Focal Resources

Refuge staff selectively filtered the list of Focal Resources for Camas NWR from Table E-1, and developed a Resources of Concern list of species that represents the collective needs of the larger groups of species or communities on the Refuge. In total, 40 representative Focal species were identified for Camas NWR (Table E-6). Collectively, these 40 focal species represent the requisite wildlife life-histories required in the management of the seven wetland and upland habitat types of Camas NWR (Tables E-7 and E-8).

Table E-5. A Subset of Resources of Concern (n=153) Representing the Species of the Greatest Conservation Need, Refuge Purposes, and the Biological Integrity of Camas Refuge

Swans
Trumpeter swan*
Tundra swan
Geese
Canada goose
Greater white-fronted goose
Dabbling Ducks
American green-winged teal
American wigeon
Cinnamon teal
Mallard
Wood duck
Northern pintail*
Gadwall
Northern shoveler
Diving Waterbirds
Barrow's goldeneye
Common goldeneye+
Bufflehead
Common loon
Red-breasted merganser+
Hooded merganser
Lesser scaup*
Ring-necked duck
Redhead
Greater scaup
Grebes
Pied-billed grebe+
Eared grebe
Clarks/Western grebe*
Pelicans and Cormorants
Double-crested cormorant
American white pelican*
Wading Birds
American avocet*
American bittern
Black-crowned night-heron
Black-necked stilt*
Cattle egret*
Great egret*
Snowy egret*
Sandhill crane*
Marsh Birds
White-faced ibis*
Shorebirds
Greater yellowlegs
Killdeer
Long-billed curlew*
Willet
Wilson's phalarope*
Western sandpiper
Least sandpiper
Spotted sandpiper
Long-billed dowitcher
Red-necked phalarope
Marbled godwit
Solitary sandpiper
Semipalmated plover Common snipe^
Terns and Gulls
Black tern*
Franklin's gull*
Ring-billed gull+
Forster's tern*
Caspian tern*
California gull*
Common tern
Raptors
Bald eagle*
Burrowing owl*
Golden eagle
Ferruginous hawk*
Merlin*
Northern goshawk
Northern Harrier
Osprey
Peregrine falcon*
Prairie falcon
Sharp-shinned hawk
Great gray owl+
Short-eared owl*
Northern saw-whet owl+
Swainson's hawk*
Turkey vulture+ American kestrel^
Corvids
Clark's nutcrancker
Black-billed magpie
Upland Game Birds
Sage grouse*
Hummingbirds
Rufous hummingbird
Calliope hummingbird
Woodpeckers
Lewis woodpecker*
Northern flicker
Red-naped sapsucker
Williamson's sapsucker
Three-toed woodpecker* Downy woodpecker^
Flycatchers
Olive-sided flycatcher
Western wood pewee
Willow flycatcher
Hammond's flycatcher
Gray flycatcher
Dusky flycatcher
Larks
Horned lark
Swallows
Violet-green swallow
Chickadees and Titmice
Mountain chickadee
Black-capped chickadee
Creepers and Nuthatches
Brown creeper
Wrens
Rock wren
Kinglets, Bluebirds, Thrushes
Townsend's solitaire
American robin+
Veery
Mockingbirds and Thrashers
Sage thrasher
Waxwings
Bohemian waxwing+
Cedar waxwing+
Shrikes
Loggerhead shrike
Vireos
Warbling vireo
Warblers
Townsend's warbler
Yellow warbler
Yellow-rumped warbler
Wilson's warbler TNC
MacGillivray's warbler
Tanagers
Western tanager
Grosbeaks, Buntings
Lazuli bunting
Towhees and Sparrows
Green-tailed towhee
Grasshopper sparrow*
Brewer's sparrow*
Vesper sparrow
Lark sparrow
Sage sparrow
Dark-eyed junco
Blackbirds, Meadowlarks, Orioles
Brewer's blackbird
Red-winged blackbird+
Yellow-headed blackbird
Bullock's oriole
Common grackle+
Western meadowlark
Finches
Cassin's finch
Pine siskin
Mammals
Gray wolfESA
Merriam's shrew*
Yuma myotis+
Western small-footed myotis+
Townsend's big-eared bat*
Spotted bat*
Great Basin ground squirrel*

Wyoming ground squirrel*
Idaho pocket gopher*
Pygmy rabbit*
Northern grasshopper mouse TNC
Sagebrush vole TNC Mink^ Muskrat^ Elk^ Moose^ Mule deer^

White-tailed deer^ Pronghorn^
Amphibians
Northern leopard frog*
Western toadTNC
Reptiles
Short-horned lizardTNC
Common garter snake+
Ringneck snake*

ESA = Listed species under the Endangered Species Act
*= Identified as a Species of Greatest Conservation Need by the ICWCS
+ = ICWCS S1, S2, S3 species not identified on any other regional plan
TNC = TNC Columbia Plateau Ecoregional Assessment species
^= Biological Integrity Species

Table E-6. Focal Resources (n=40) for Camas Refuge

Swans
Trumpeter swan
Geese
Canada goose
Dabbling Ducks
Cinnamon teal
Northern pintail
Northern shoveler
Diving Waterbirds
Lesser scaup
Redhead
Grebes
Eared grebe
Pelicans and Cormorants
American white pelican
Wading Birds
American avocet
Sandhill crane
Marsh Birds
White-faced ibis
Shorebirds
Long-billed curlew
Marbled godwit
Common snipe
Terns and Gulls
Franklin's gull
Raptors
Bald eagle
Short-eared owl
Peregrine falcon
American kestrel

Upland Game Birds
Greater sage-grouse
Woodpeckers
Downy woodpecker
Flycatchers
Willow flycatcher
Olive-sided flycatcher
Western wood-pewee
Mockingbirds and Thrashers
Sage thrasher
Shrikes
Loggerhead shrike
Vireos
Warbling vireo
Warblers
Yellow warbler
Blackbirds, Meadowlarks, Orioles
Western meadowlark
Mammals
Ground squirrel spp.
Pygmy rabbit
Sagebrush vole
Mink
Muskrat
Elk
White-tailed deer
Pronghorn
Moose
Amphibians
Northern leopard frog

Table E-7. Focal Species Comparison by Breeding and Foraging Habitats of Camas Refuge

<table>
<tr><th>Habitat Type</th><th>Breeding</th><th>Foraging</th><th>Other</th></tr>
<tr><td rowspan="2">Hemi-Marsh

(50:50-Open water/Submerged aquatic: Deep Emergent-bulrush/cattail)</td><td colspan="2">Trumpeter swan
Eared grebe
Redhead
Muskrat</td><td rowspan="2">White-tailed deer (Winter)</td></tr>
<tr><td>Franklin’s gull
White-faced ibis</td><td>Mink
Cinnamon teal
Northern pintail
Northern shoveler
Lesser scaup
American white pelican
Peregrine falcon
Mink</td></tr>
<tr><td rowspan="2">Shallow Marsh</td><td colspan="2">Northern leopard frog</td><td rowspan="2">Northern leopard frog-(Winter)</td></tr>
<tr><td>Sandhill crane</td><td>Cinnamon teal
White-faced ibis
Eared grebe
Northern pintail
Common snipe
Moose</td></tr>
<tr><td rowspan="2">Wet Meadow

(Sedge, rushes, grasses)</td><td colspan="2">Sandhill crane
American avocet</td><td rowspan="2"></td></tr>
<tr><td>Cinnamon teal
Northern shoveler
Common snipe</td><td>White-faced ibis
Long-billed curlew
Marbled godwit
Franklin’s gull
Short-eared owl
Western meadowlark</td></tr>
<tr><td rowspan="2">Dry Meadow

(Grasses, forbs)</td><td colspan="2">Long-billed curlew
Canada goose</td><td rowspan="2"></td></tr>
<tr><td>Lesser scaup
Western meadowlark
Short-eared owl
Sandhill crane</td><td>Franklin’s gull</td></tr>
<tr><td rowspan="2">Sagebrush Steppe

(Sagebrush, rabbitbrush, bitterbrush, bunchgrass, forbs)</td><td colspan="2">Greater sage-grouse
Sage thrasher
Loggerhead shrike
Sagebrush vole
Pygmy rabbit
Pronghorn
Ground squirrel spp.</td><td rowspan="2"></td></tr>
<tr><td>Northern pintail
Long-billed curlew</td><td>Elk</td></tr>
<tr><td rowspan="2">Riparian

(Willow, grasses)</td><td colspan="2">Willow flycatcher
Yellow warbler</td><td rowspan="2">Greater sage-grouse (Brood and Winter)
Elk (Security Cover)</td></tr>
<tr><td></td><td>Greater sage-grouse
Elk
Moose</td></tr>
<tr><td>Shelterbelt

(Cottonwood, small trees, shrubs)</td><td colspan="2">Warbling vireo
Western wood-pewee
Downy woodpecker
American kestrel</td><td>Bald eagle (Winter roosting)</td></tr>
</table>

Habitat Type	Breeding	Foraging	Other
		Yellow warbler Olive-sided flycatcher	
Agriculture (Small grains, legumes, fallow)		Sandhill crane Canada goose Long-billed curlew Elk White-tailed deer	Greater sage-grouse-(Brood)

E.4 Conservation Targets

For planning purposes, the Service uses priority conservation targets as surrogates to represent the diverse realm of wildlife, plants, and habitats to be managed at Camas NWR. The conservation targets identified for Camas NWR are the result of sequentially aggregating 292 wildlife species or resources of concern (Table E-2) and stepping those down to a subset of 153 resources of concern of the greatest conservation need (Table E-5). Subsequently, 40 focal wildlife species (Table E-6). The 40 focal species life history strategies were used to identify characteristic plant communities, natural ecological processes, and limiting factors for eight predominant refuge habitat types (Table E-7).

Ultimately, eight representative habitat-based conservation targets were developed from 40 focal wildlife species with life history requirements representative of the habitats structure and function required to maintain or improve the ecological integrity of refuge habitats (Table E-8). All management objectives and strategies developed in the CCP are subsequently designed to abate threats or to enhance the viability of a conservation target's contribution to the ecological integrity of Camas NWR.

E.4.1 Desired Future Conditions

The description of habitat structure (Table E-8) for a given conservation target defines the target's desired future condition and the key ecological attributes and critical components of a conservation target's life history, habitat, physical processes, or community interaction. While the desired future condition may not be achievable in all situations due to the degree of change of ecological attributes from historic conditions, threats to diversity and opportunities to enhance desired future conditions are more clearly identified through comparison of potential natural conditions and the range of natural variability, with existing conditions. In other words, if the characteristics described were degraded or missing, it would seriously jeopardize the target's, and possibly the Refuge's, ecological integrity.

Table E-8. Conservation Targets for Camas National Wildlife Refuge

Focal Species	Desired Future Conditions of Habitat Structure	Life History	Other Benefiting Focal Species
Hemi-Marsh Open Water/Dense Marsh (Permanent and Semi-Permanent wetlands)			
Trumpeter swan *Cygnus buccinator*	Wetlands 1->500 ha (1->1,235 acres), 0.3-1 m (1-3.3 feet) deep, open water: emergent vegetation ratios 30:70 to 70:30, with abundant, diverse submerged aquatic vegetation and invertebrate populations, with emergent beds of *Schoenoplectus* or *Typha*, with muskrat or beaver houses, hummocks or islands for nesting, and with little to no human disturbance (Banko 1960; Mitchell 1994).	Breeding; Foraging (Vegetative)	Canada goose (on muskrat houses or floating platforms), canvasback, redhead, lesser scaup
Eared grebe *Podiceps nigricollis*	Shallow, eutrophic wetlands 0.4->4 ha (1->9.9 acres), 80% open water <1.2 m (<3.9 feet) deep, with open to dense emergent cover for nesting. Requires highly productive macroinvertebrate (Heteroptera, Crustacea, Mollusca) food source in water <1.7 m (<5.6 feet) deep (Johnsgard 1987).	Breeding: Foraging-Invertebrate	Ruddy duck, ring-necked duck, bufflehead, Barrow's goldeneye
Redhead *Aythya americana*	Uses wide range of wetlands. Most commonly uses larger (>4.0 ha [10 acres]) seasonally and semi-permanently flooded wetlands but will use smaller wetlands with adequate water (Woodin and Michot 2002), generally nests over or near (<13 m [<42.6 feet]) water in emergent vegetation, preferably *Schoenoplectus* spp. (Bellrose 1976). Feeds primarily (~90%) on a wide variety of submerged aquatic plants and plant parts (Bellrose 1976; Woodin and Michot 2002) in waters 1-3 m (3.3-9.9 feet) deep.	Breeding; Foraging	American coot, mallard, muskrat, mink, western grebe, American wigeon, cinnamon teal, gadwall, northern shoveler
Muskrat *Ondatra zibethicus*	Lentic-lotic wetlands with humus-peaty soils, having current or depth sufficient to prevent freezing to bottom. Ponds >0.5 ha (>1.2 acres), but too large may have wave action sufficient to destroy vegetation. Emergent vegetation beds containing *Schoenoplectus*, *Typha*, or *Scirpus*. Abundant submergent aquatic vegetation (Erb and Perry 2003; Errington 1961, 1963).	Breeding; Foraging Over-Winter Survival	Mink
Mink *Mustela vison*	Secure water supplies supporting lentic-lotic wetlands with ponds >0.5 ha (>1.2 acres) with irregular shorelines. Wetlands with both abundant open water and extensive, robust emergent vegetation beds (hemi-marsh), plus abundant submergent aquatic vegetation. Plentiful prey coverts such as brushpiles, overhanging banks or vegetation, and grassy or brushy banks. Abundant fish (small and slow moving), amphibians, crustaceans, muskrats, mice, voles and other small mammals for prey (Lariviere 2003).	Breeding, Foraging, Over-Winter Survival	Muskrat
White-faced ibis *Plegadis chihi*	Dense, tall (>0.5-1 m [1.6-3.3 feet]) emergent vegetation (*Schoenoplectus*, *Typha*, or *Scirpus*), in shallow water 0.25-0.5 m (0.8-1.6 feet) deep (Ryder and Manry 1994).	Breeding (Colonial)	Franklin's gull, Forster's tern, marsh wren, sora rail
Franklin's gull *Leucophaeus pipixcan*	For nesting, wetlands with available floating mats or dense emergent stands cattails (*Typha* spp.), bulrushes (*Scirpus* spp.), muskrat houses, or floating	Foraging (Aerial/Surface	White-faced ibis, Forster's tern, marsh wren, sora rail

Focal Species	Desired Future Conditions of Habitat Structure	Life History	Other Benefiting Focal Species
	debris for substrate; water depths 30-60 cm (11.8-23.6 inches), with extremes of 12-180 cm (4.7-70.1 inches).; preferred habitat is moderate density vegetation interspersed with variable-size open water (hemi-marsh). Productive vegetation providing substrate for invertebrate forage production such as insects (particularly midges [Chironomidae]) and dragonflies [Odonata]), for hawking over water surface (Burger and Gochfeld 2009).	insectivore) Breeding (Colonial)	
American white pelican *Pelecanus erythrorhychos*	Wetlands with large open water expanses containing abundant fish and amphibian (tiger salamanders [*Ambystoma tigrinum*]) prey species; 18-36 inch depth.	Foraging (Surface gleaning Piscivore)	Forster's tern
Peregrine falcon *Falco peregrinus*	Productive marshes supporting an abundant and diverse population of passerines, shorebirds, and waterfowl; during breeding season, adjacent to suitable nesting habitat (Snow 1972).	Foraging (Aerial carnivore)	Bald eagle, golden eagle, merlin, northern harrier
Northern shoveler *Anas clypeata*	Feeds in both deep, particularly on surface phytoplankton, and shallow water on copepods, ostracods and invertebrates, specifically corixids aquatic coleopterans, midge and caddis larvae. Agrostologically diverse nesting habitat preferred, tending toward shorter stature grasses; generally minimum of 70-200 feet from water (Bellrose 1976).	Breeding, Foraging	Northern pintail, cinnamon teal
Lesser scaup *Aythya affinis*	Uses diverse array of wetland sizes and configurations, but generally needs productive hemi-marsh or small wetlands/potholes containing diverse animal matter forage. Foraging depths of 12-36 inches selected. Preferred nesting habitat of ungrazed grasslands adjacent to permanent wetlands ≥10 feet deep and 2.1-5.0 acres in size, but also will use sedges or rushes, as well as floating or semi-floating mats of vegetation in over water context; also known to use islands; generally within 50 yards of water (Bellrose 1976).	Foraging (Diving omnivore)	Northern pintail, cinnamon teal, northern shoveler
White-tailed deer *Odocoileus virginianus*	Dense stands of emergent cattail and bulrush for escape cover and winter thermal cover; preferably adjacent to agricultural fields, or other upland habitats providing additional forage resources. Hemi-marsh habitat also providing some nutritional attributes.	Winter	Elk, moose
Shallow Marsh (Seasonal wetlands)			
Northern leopard frog *Rana pipiens*	Use wide variety of wetland sizes, especially <4 ha (<9.9 acres), and types with variable hydroperiods (>30 days and <365 days), in complexes <300 m (<984 feet) apart with good water quality (no pollutants), moderate emergent vegetation cover, with high invertebrate densities, and substrates suitable for burrowing (hibernation), without predatory fish, and associated wet meadows (Black and Craig 1970; Burton et al. 2006; Nussbaum et al. 1983; Semlitsch 2000).	Breeding; Foraging- (Insects)	Sora, marsh wren, common snipe
Greater sandhill crane *Grus canadensis tabida*	Marshes with adequate water levels during the nesting period, averaging 9-10 inches deep (Littlefield and Ivey 2002). Fully structured emergent marsh vegetation stands capable of supporting substantial nest platforms (e.g.,	Breeding	Sora, marsh wren, eared grebe, northern pintail

Focal Species	Desired Future Conditions of Habitat Structure	Life History	Other Benefiting Focal Species
	hardstem bulrush, common cattail; >30% but <90% residual vegetation) (Littlefield 1995). Adjacent wet meadow habitat to enhance foraging by colts.		
Common snipe *Gallinago gallinago*	Shallow, stable, discontinuous water levels, moist to saturated organic soils, often with hummocks, containing insect larvae, earthworms, snails and other animal foods, emergents consisting of low, sparse *Carex* (Arnold 1994).	Foraging	White-faced ibis, eared grebe
White-faced ibis *Plegadis chihi*	Prefers shallow inundated wetlands of low, emergent sedges, spikerushes, saltgrass, and other species. Nearby irrigated crops, particularly alfalfa, barley, and native hay meadows, are important feeding sites (Ryder and Manry 1994).	Foraging	Sora, marsh wren, eared grebe, northern pintail
Northern pintail *Anas acuta*	Foraging depth 0-12 inches. During breeding season feeds in shallow, temporary to semi-permanent wetlands (Austin and Miller 1995). Open areas of short or thin upland vegetation preferred more than other ducks. Prefers to nest farther from water than other ducks, up to 1 mile, but with average of 40 yards. Vegetation ranges from bulrush and willows through rush and weeds at nest sites; will use farm fields (Bellrose 1976).	Foraging, Breeding	Cinnamon teal
Eared grebe *Podiceps nigricollis*	Shallow, eutrophic wetlands 0.4->4 ha (1->9.9 acres), 80% open water <1.2 m (<3.9 feet) deep. Requires highly productive macroinvertebrate (Heteroptera, Crustacea, Mullosca) food source in water <1.7 m (<5.6 feet) deep (Johnsgard 1987).	Foraging	Sora, marsh wren, eared grebe, northern pintail
Moose *Alces alces*	Spring and summer forage augmenting willow provided by aquatic plants available in productive shallow hemi-marsh habitat. Fertile marsh sites providing high volumes of very digestible marsh plants that are also sodium providers (Bowyer et al. 2003).	Foraging	White-tailed deer
Wet Meadow (Temporary Wetlands)			
Greater sandhill crane *Grus canadensis tabida*	Tall to short emergent graminoids, *Carex*, *Juncus* usually surrounded by shallow (0.25 m [0.8 feet]) to deep (0.65 m [2.1 feet]) open water (Austin et al. 2007).	Breeding	Canada goose, long-billed curlew (Foraging)
American avocet *Recurvirostra americana*	Sparsely vegetated salt flats or mudflats adjacent (<0.2 mile) to shallow (<3 feet deep) alkaline or brackish water (Dechant et al. 2002; Floyd et al. 2007). Short, sparse vegetation (<24 inches) that provides an unobstructed view from the nest (Dechant et al. 2002). Water permanence through July to ensure brood habitat for fledgling shorebirds.	Foraging/ Migration/ Nesting	Wilson's phalarope, black-necked stilt, willet
Cinnamon teal *Anas cyanoptera*	Dense emergent cover of graminoids, *Eleocharis* or *Carex* < 1 m (<3.3 feet) tall, usually within 50 m (164 feet) open water (Bellrose 1976; Palmer 1976).	Breeding/ Foraging- (Vegetative)	American widgeon, gadwall, mallard, northern shoveler, meadow vole, montane vole
Common snipe *Gallinago gallinago*	Emergents consisting of low, sparse sedge (Arnold 1994), rushes, and grasses.	Breeding	N. leopard frog, sora, marsh wren, northern pintail
Long-billed curlew *Numenius americanus*	Shallow wetlands, short meadows and grasslands with soft, deep (2-15 cm [0.8-5.9 inches]) soils (Dugger and Dugger 2002; Jenni et al. 1981) with invertebrates.	Foraging (insects)	Willet, yellow-legs
Marbled godwit	Uses a variety of wetland types, temporary wetlands, muddy margins of large,	Migratory	Long-billed dowitcher, Wilson's

Focal Species	Desired Future Conditions of Habitat Structure	Life History	Other Benefiting Focal Species
Limosa fedoa	drying reservoirs, shallow ponds with little or no emergent vegetation (Gratto-Trevor 2000; Skagen et al. 1999), also native grasslands and tame hay fields to probing for earthworms, aquatic insects, aquatic plant tubers, leeches, also Orthoptera and small fish. Most often seen in smaller marsh habitats with bulrush *Schoenoplectus* spp., spike-rushes *Eleocharis* spp. rush *Juncus* spp., whitetop *Scolochloa festucacea*, and cattail *Typha* spp.) (Gratto-Trevor 2000).	Spring and Fall Foraging	phalarope
White-faced ibis *Plegadis chihi*	Shallow open water (<12 cm [4.7 inches]) to scattered emergent *Carex*, *Juncus* stands with variable hydroperiod and abundant macroinvertebrates through late August (Perkins 2003).	Foraging-(Insects)	Snowy egret, Franklin's gull; Virginia rail, greater yellow-legs (migration)
Franklin's gull *Lauecophaeus pipixcan*	Productive vegetation providing substrate for invertebrate forage production such as insects (particularly midges [Chironomidae]) and dragonflies [Odonata]), for hawking over water surface (Burger and Gochfeld 2009).	Foraging (Aerial/Surface insectivore)	White-faced ibis
Short-eared owl *Asio flammeus*	Prefers open habitat with cyclic small mammals, such as voles, typically large expanses of plains-type grasslands, or meadows and agricultural areas (Wiggins et al. 2006). Prefers grasslands and marshy habitats (Ryser 1985).	Foraging (Aerial carnivore)	Franklin's gull
Dry Meadow (Uplands)			
Long-billed curlew *Numenius americanus*	Open short-grass or mixed grass-forb habitat with level to slightly rolling topography (Dugger and Dugger 2002) with intermittent patchy vegetation (<2.5 acres, <5% of total area) of tall, dense foliage (>7 inches high) (Pampush and Anthony 1993; Oreing et al. 1999), void of trees, high-density shrubs, and tall, dense grasses (Pampush and Anthony 1993). Buffer zones 325-5,445 yards around a territory that is unoccupied by other curlews (Paige and Ritter 1999). Contiguous suitable habitat >100 acres (capable of supporting at least 1 breeding pair) protected from detrimental human disturbance (Dechant et al. 2003; Redmond et al. 1981).	Breeding/ Foraging	Greater sandhill crane, vesper sparrow, killdeer, Swainson's hawk, short-eared owl
Canada goose *Branta canadensis moffitti*	Lightly grazed areas with taller (>0.3 m [>0.9 feet]) graminoids, *Carex*, *Juncus*, etc. near water (Austin et al. 2002; Austin and Pyle 2004).	Breeding/ Foraging	Horned lark, bobolink
Lesser scaup *Aythya affinis*	Preferred nesting habitat of ungrazed grasslands adjacent to permanent wetlands ≥10 feet deep and 2.1-5.0 acres in size; generally within 50 yards of water (Bellrose 1976).	Breeding	Horned lark, bobolink, western meadowlark
Western meadowlark *Sturnella neglecta*	A grassland generalist, but prefers native grasslands and reclaimed (perennial grass species) agricultural fields. Selects areas of relatively robust cover structure (grass, forbs, and litter). Some avoidance of tall, dense, or woody cover. Feeds on the ground in open areas. Diet consists largely of grain and weed seeds and insects, including beetles, weevils, wireworms, cutworms, grasshoppers, and crickets. Marked seasonal differences in main staples: grain during winter and early spring, insects late spring and summer, weed seeds in fall (Davis and Lanyon 2008).	Foraging, Breeding	Horned lark, bobolink, lesser scaup
Short-eared owl *Asio flammeus*	Prefers patches of relatively thick grassland for nesting. Nest sites characterized by high vegetative visual obstruction (Wiggins et al. 2006).	Breeding	Horned lark, bobolink, western meadowlark, lesser scaup

Focal Species	Desired Future Conditions of Habitat Structure	Life History	Other Benefiting Focal Species
Franklin's gull *Leucophaeus pipixcan*	Healthy native vegetation stands supporting abundant invertebrate populations and providing interspersed segments of short vegetation and/or bare ground; allows terrestrial foraging (pedestrian flocks of gulls generally forage for earthworms, insects and grain (Burger and Gochfeld 2009).	Foraging	Horned lark, bobolink, western meadowlark
Sagebrush Steppe (Uplands)			
Greater sage-grouse *Centrocercus urophasianus*	Habitats dominated by low sagebrush (<15 inches high; 10-25% cover) with native forbs (10-20% cover), native perennial grasses (10-15% cover) (Connelly et al. 2000), and western juniper densities of <4 trees/acre. Late-seral sagebrush 10-14 inches tall and 10-20% canopy cover above snow during winter (Connelly et al. 2000). Mid-seral sagebrush 12-31 inches tall and 15-20% canopy cover. Native bunchgrasses and forbs >7 inches tall and >15% cover (Connelly et al. 2000).	Breeding/ Foraging	Sharp-tailed grouse, sage sparrow, ferruginous hawk, merlin, Swainson's hawk, golden eagle, prairie falcon, Brewers sparrow, Merriam's shrew, Idaho pocket gopher, ground squirrel spp., burrowing owl
Sage thrasher *Oreoscoptes montanus*	Occurs in shrub (sagebrush, bitterbrush, greasewood) with canopy cover 11-44%, height 30-60 cm (11.8-23.6 inches), with few to no annual grasses, more bare ground. Nests in taller, denser shrubs with wider canopies. Forages primarily on invertebrates on open ground, occasionally eats berries (Reynolds et al. 1999).	Breeding/ Foraging	Sharp-tailed grouse, sage sparrow, ferruginous hawk, Swainson's hawk, golden eagle, Brewer's sparrow, Merriam's shrew, Idaho pocket gopher, ground squirrel spp.
Loggerhead shrike *Lanius ludovicianus*	Forages in mixed shrub-steppe and grasslands often with bare ground, where grasshoppers, small reptiles, and small mammals are abundant; nesting in tall (>2 m [6.6 feet]), isolated shrubs (Yosef 1996).	Breeding/ Foraging	Sage sparrow, Brewer's sparrow, sage-grouse, golden eagle, ground squirrel spp.
Sagebrush vole *Lemmus curtatus*	Semi-arid sites with loose, well-drained soil, with sagebrush, rabbitbrush, and bunchgrasses (including crested wheatgrass). Eats green vegetation (leaves, stems) and seeds (Carroll and Genoways 1980).	Breeding/ Foraging	Sage sparrow, Brewer's sparrow, sage-grouse, red-tailed and Swainson's hawks, golden eagle, Merriam's shrew, ground squirrel spp.
Pygmy rabbit *Brachylagus idahoensis*	Found in big sagebrush (*A. tridentata*) dominated sites with tall, dense plants and forbs. Largely browsers on sagebrush and Purshia (Green and Flinders 1980). Live in small burrows and may be limited to soils suitable for burrowing (Heady and Laundre 2005).	Breeding/ Foraging	Merriam's shrew, sagebrush vole, ground squirrel spp., sage thrasher, red-tailed and Swainson's hawks
Pronghorn *Antilocapra americana*	Pronghorn forage in sagebrush-steppe habitats with >50% plant cover year-round, foraging on forbs in spring through fall, and on sagebrush and other shrubs in winter. Pronghorn does also fawn in sagebrush stands (Byers 2003; O'Gara and Yoakum 2004).	Breeding/ Foraging	Sage sparrow, Brewer's sparrow, sage-grouse, red-tailed and Swainson's hawks, golden eagle, Merriam's shrew, sagebrush vole, ground squirrel spp.
Great Basin and/or Uinta ground squirrel *Spermophilus* spp. (*S. mollis and/or S. armatus* ?)	Soft, well-drained soils on gentle slopes with good visibility in sage-steppe habitats. Eat green vegetation (grasses and forbs), leaves, stems, flowers, seeds, occasionally insects (Yensen and Sherman 2003a, b).	Breeding/ Foraging	Sage sparrow, Brewer's sparrow, sage-grouse, red-tailed and Swainson's hawks, golden eagle
Northern pintail *Anas acuta*	Brush and shrubs provide attractive nesting habitat. An early nester, pintails rely on residual cover for nest concealment and are more likely to be negatively affected by grazing or other management techniques that reduce residual cover	Breeding	White-crowned sparrow, lazuli bunting

Focal Species	Desired Future Conditions of Habitat Structure	Life History	Other Benefiting Focal Species
	than are later-nesting species (Austin and Pyle 2004; Kruse and Bowen 1996).		
Elk *Cervus elaphus*	Elk use sagebrush-steppe habitats to forage (forbs and grasses, with limited browsing on some shrub species), and calve in, as security when the group sizes become very large (Peek 2003), dense riparian thickets are disturbed, to bed in summer, and as travel corridors to feeding sites off-Refuge (C.D. Mitchell, pers. obs.).	Foraging/other	Sage sparrow, Brewer's sparrow, sage-grouse, red-tailed and Swainson's hawks, golden eagle, Merriam's shrew, sagebrush vole, ground squirrel spp.
Riparian			
Willow flycatcher *Empidonax traillii*	Willow stands, riparian shrubs and open woodlands with trees 1-8 m (3.3-26.2 feet) tall, with edges of open understory (DeGraaf et al. 1991).	Breeding/ Foraging	Other *Empidonax* flycatchers, yellow warblers
Yellow warbler *Setophaga petechia*	Willow stands, riparian shrubs, forest edges, thickets, and woodlands with trees 1-11 m (3.3-36 feet) tall near wetlands (DeGraaf et al. 1991).	Breeding/ Foraging	*Empidonax* flycatchers
Greater sage-grouse *Centrocercus urophasianus*	Sage grouse adults and young forage on short herbaceous vegetation and invertebrates in and near riparian zones (Schroeder et al. 1999).	Foraging	Elk, American robin, ground squirrels
Elk *Cervus elaphus*	Elk forage on herbaceous and graminoid vegetation in and near riparian zones, and use (2-3 m+ [6.6-9.9 feet+]) woody willow stands for security (hiding) cover, browse during hard winters with deep snow, and as sites for bulls to clean antlers, display, and tend harems during rut (Peek 2003).	Foraging/ Security/ Reproduction	Moose, sage-grouse, American robin, ground squirrels
Moose *Alces alces shirasi*	Uses moderate to dense stands of willow for security (hiding) cover, and forages on new terminal willow growth during winter (Bowyer et al. 2003; Franzmann and Schwartz 1998).	Foraging/ Security	Elk, sage-grouse, American robin, ground squirrels
Shelterbelt			
Warbling vireo *Vireo gilvus*	Willow stands, riparian shrubs and open woodlands with trees 1-8 m (3.3-26.2 feet) tall, with edges of open understory (DeGraaf et al. 1991).	Breeding/ Foraging	Other *Empidonax* flycatchers, yellow warblers
Western wood-pewee *Contopus sordidulus*	Habitat generalist, widespread in cottonwood and other woodlands and forests, especially forest edge and riparian zones. Habitat components include large tree diameters, open understory, edge, and dead trees or trees with dead limbs. High, exposed perches on tops and outer canopy of trees and wires. Forages on insects between 6-25 m (20-82 feet), mostly in upper 25% of canopy; 65% of foraging time spent at 6-12 m (20-82 feet) (Bemis and Rising 1999).	Breeding/ Foraging	*Empidonax* flycatchers, olive-sided flycatcher, downy woodpecker, American kestrel
Downy woodpecker *Picoides pubescens*	Breeds in open, deciduous, especially riparian, woodlands throughout its range. Favors cottonwoods (*Populus* spp.) on the plains. Highest densities in deciduous woodlands that include small trees with low canopy heights. Nests in cavity in dead stub of a living or dead tree >15 cm (>5.9 inches) DBH in wood with advanced heartrot. Eats insects, arthropods, fruits, seeds, sap. Males usually forage on small-diameter branches and stems of weeds, females on the larger branches and trunks of trees (Jackson and Ouellet 2002).	Breeding/ Foraging	Warbling vireo and other peewees, *Empidonax* flycatchers, olive-sided flycatcher, warbling vireo, American kestrel
American kestrel *Falco sparverius*	Wide variety of open to semi-open habitats, including meadows, grasslands, early successional communities, open parkland, agricultural fields, and both urban and suburban areas; regardless of dominant vegetation form. Breeding	Breeding/ Foraging	*Empidonax* flycatchers, western wood-pewee, olive-sided flycatcher, downy woodpecker

Focal Species	Desired Future Conditions of Habitat Structure	Life History	Other Benefiting Focal Species
	territories characterized by either large or small patches covered by short ground vegetation, with taller woody vegetation sparsely distributed or lacking. Suitable nest trees and perches required. American kestrels breed in cavities in trees >12 inches DBH, and use trees as perches to make territorial displays from, and to forage on macro-invertebrates, small birds and small mammals (Smallwood and Bird 2002).		
Yellow warbler *Setophaga petechia*	Habitats best categorized as wet, deciduous willow (*Salix* spp.) thickets in disturbed or early successional habitats (Lowther et al. 1999). Forage on invertebrates on woody vegetation, occasionally hawking, in height classes 0.3-15 m (0.9-49.2 feet).	Breeding/ Foraging	*Empidonax* flycatchers, western wood-pewee, olive-sided flycatcher
Olive-sided flycatcher *Contopus cooperi*	Breeds in habitat along forest edges and openings, including burns, marshes, and open water, semi-open forest. Tall, prominent trees and snags, which serve as singing and foraging perches, and unobstructed air space for foraging, are common features of all nesting habitats. Frequently occurs along wooded shores of streams, lakes, rivers, ponds, where natural edge habitat occurs and standing dead trees often are present. Presence near water may be due to higher insect abundance in these areas (Altman and Sallabanks 2000).	Breeding/ Foraging	*Empidonax* flycatchers, downy woodpecker, American kestrel
Bald eagle *Hailaeetus leucocephalus*	Roost trees from 30 to 110 cm (11.8-43.3 inches) DBH and 15 to 60 m (49.2-196.9 feet) in height, near open areas that provide easy access, and dense enough to provide some wind breaks, are typically used. Roost sites usually located away from houses and roads, <10 to >29 km (<6.2->18 miles) from foraging areas (Buelhler 2000).	Winter roosting	*Empidonax* flycatchers, olive-sided flycatcher, western wood-pewee, downy woodpecker, American kestrel
Agriculture			
Greater sandhill crane *Grus canadensis tabida*	Open fields away from dense grassland, shrub or riparian cover with low (<0.5 m [<1.6 feet]) grain height, preferably with two-row awn-less barley in fall. Bare fields also provide important foraging for waste grain, earthworms and other invertebrates in early spring immediately after arrival when fields are typically melted off but before snow cover is completely gone from grasslands. (Austin et al. 2002; Austin et al. 2007; Drewein 1973; Littlefield 1995).	Foraging-Fall Migration	Canada goose, mallard, red-winged and Brewer's blackbirds, Swainson's hawk
Canada goose *Branta canadensis moffitti*	Open fields away from dense grassland, shrub or riparian cover with low (<0.5 m [<1.6 feet]) grain height in fall. Bare fields also provide important foraging for waste grain, earthworms and other invertebrates in early spring immediately after arrival when fields are typically melted off but before snow cover is completely gone from grasslands.	Foraging-Spring and fall migration	Sandhill crane, mallard, red-winged and Brewer's blackbirds
Long-billed curlew *Numenius americanus*	Open fields away from dense grassland, shrub or riparian cover with low (<0.5 m [<1.6 feet]) grain height in fall. Bare fields also provide important foraging for earthworms and other invertebrates in early spring immediately after arrival when fields are typically melted off but before snow cover is completely gone from grasslands.	Foraging-Spring	Sandhill cranes, pintails, mallards, red-winged and Brewer's blackbirds
Elk *Cervus elaphus*	Open fields near from dense grassland, shrub or riparian cover with low (<0.5 m [<1.6 feet]) grain height in fall. Highly opportunistic foragers, elk may	Foraging	White-tailed deer, sandhill crane, Canada goose, pintail, mallard

Focal Species	Desired Future Conditions of Habitat Structure	Life History	Other Benefiting Focal Species
	forage on weeds, growing grain plants, as well as grain after it matures (Peek 2003). They may also use open fields for display and breeding, and to avoid predators.		
White-tailed deer *Odocoileus virginianus*	Open fields near dense grassland, shrub or riparian cover with low (<0.5 m [<1.6 feet]) grain height in fall. White-tailed deer may forage on growing grain plants, as well as grain after it matures. They may also use open fields for display and breeding, or to avoid predators (Miller et al. 2003).	Foraging	Elk, sandhill crane, Canada goose, pintail, mallard, red-winged and Brewer's blackbirds
Greater sage-grouse *Centrocercus urophasianus*	Open fields near dense grassland, or shrub-steppe cover with low (<0.5 m [<1.6 feet]) grain height in fall (Schroeder et al. 1999). In fall and winter, sage-grouse forage in open grain fields, especially if located nearby sage-steppe vegetation.	Foraging-Fall	White-tailed deer, elk, sandhill crane, Canada goose, pintail, mallard, red-winged and Brewer's blackbirds

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Appendix F. Integrated Pest Management Plan

1.0 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 would 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 would be particularly relevant where long-term impacts may be uncertain and future monitoring would 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, would 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 would be considered when determining feasibility/practicality of various treatments.

IPM techniques to address pests are presented as CCP strategies or HMP prescriptions (see Chapter 2) 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 Section 4.0 (Environmental Consequences) of this CCP Only pesticide uses that likely would cause minor, temporary, or localized effects to refuge biological resources and environmental quality with appropriate 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. However, the basic framework to assess potential effects to refuge biological resources and environmental quality from aerial application of pesticides would be similar to the process described in this Appendix for ground-based treatments of other pesticides.

2.0 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, which 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 staffs and public (e.g. auto tour routes) driving on structurally compromised levees and dikes can be threaten 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]).

3.0 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:

- **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 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 staffs, their authorized agents, and refuge volunteers would, where possible, inspect, remove, and properly dispose of seed and parts of invasive plants found on their clothing and equipment. Proper disposal means bagging the seeds and plant parts and then properly discarding of them (e.g., incinerating).
- The refuge staff would evaluate options, including closure, to restrict the traffic on sites with 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 l00-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 US Forest Service (2005).

- **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, sheering, 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.

- **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.

- **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 US 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, 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, US Forest Service, National Park Service, US 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.

- **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.

- **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 Shelly 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.

4.0 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 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.

5.0 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 Pest Management Policy and Responsibilities (30 AM 12), 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.

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.

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<7mph and preferably 3 to 5 mph) and consistent direction wind conditions with moderate temperatures (typically <85 ^{o}F).
- Where possible, applicators would avoid spraying during inversion conditions (often associated with calm and very low wind conditions) that can cause large-scale herbicide drift to 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.

6.0 Safety

6.1 Personal Protective Equipment

All applicators would wear the specific personal protective equipment (PPE) identified on the pesticide label. The appropriate PPE will be worn at all times during handling, mixing, and applying. PPE can include the following: disposable (e.g., Tyvek) or laundered coveralls; gloves (latex, rubber, or nitrile); rubber boots; and/or 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 will 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.

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.

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 FW7.7A, "**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 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.

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 FW7.18A 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.

6.5 Record Keeping

6.5.1 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.

6.5.2 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]), a refuge staff may receive up to five-year approvals for Washington Office and field reviewed proposed pesticide uses based upon meeting identified criteria including an approved IPM plan, where necessary (see http://www.fws.gov/contaminants/Issues/IPM.cfm). For a refuge, an IPM plan (requirements described herein) can be completed independently or in association with a CCP or 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.

6.5.3 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, dessicants, herbicides, fungicides, rodenticides, acaricides, nematicides, fumigants, avicides, and piscicides.

The following usage information can be reported for approved PUPs in the PUPS database:

- Pesticide trade name(s)
- Active ingredient(s)
- Total acres treated
- Total amount of pesticides used (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.

7.0 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 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 4.0) 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.

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 US

Environmental Protection Agency (2004). Assumptions for these risk assessments are presented in Section 6.2.3.

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 7.5.

Table 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.

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 (US Environmental Protection Agency 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 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 US Environmental Protection Agency (1998 [Table 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 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 2. Presumption of unacceptable risk for birds, fish, and mammals (US Environmental Protection Agency 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

7.2.1 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*a*). 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).

7.2.1.1 Terrestrial exposure

The ECC for exposure to terrestrial wildlife would be quantified using an USEPA screening-level approach (US Environmental Protection Agency 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.

7.2.1.1.1 Terrestrial-spray application

For spray applications, exposure would be determined using the Kanaga nomogram method (US Environmental Protection Agency 2005*a*, US Environmental Protection Agency 2004, Pfleeger et al. 1996) through the USEPA's Terrestrial Residue Exposure model (T-REX) version 1.2.3 (US Environmental Protection Agency 2005*b*). 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 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 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

Species	Body Weight (kg)
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 (1000 g)	1.000
Mallard	1.082
Ring-necked pheasant	1.135

7.2.1.1.2 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 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 (US Environmental Protection Agency 1998). The T-REX version 1.2.3 (US Environmental Protection Agency 2005*b*) contains a submodel which automates Kanaga exposure calculations for granular pesticides and treated seed.

The following formulas will be used to calculate EECs depending upon the type of granular pesticide application:

- In-furrow applications assume a typical value of 1% 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

$$mg\ a.i./ft^2 = [(lbs\ product/1000\ ft.\ row)(\%\ a.i.)(1000\ ft\ row)(453{,}580\ mg/lb.)(1\%\ exposed)$$

$$EEC = [(mg\ a.i./ft.^2)(\%\ of\ pesticide\ biologically\ available)]$$

- Incorporated banded treatments assume that 15% of granules, bait, and seeds are unincorporated.

$$mg\ a.i./ft.^2 = [(lbs.\ product/1000\ row\ ft.)(\%\ a.i.)(453{,}580\ mg/lb.)(1\text{-}\%\ incorporated)] / (1{,}000\ ft.)(band\ width\ (ft.))$$

$$EEC = [(mg\ a.i./ft.^2)(\%\ of\ pesticide\ biologically\ available)]$$

- 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 divided by the surrogate LD_{50} toxicological endpoint multiplied by the body weight (Table 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.

7.2.1.2 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.

7.2.1.2.1 Habitat treatments

For the worst-case exposure scenario to non-target aquatic habitats, EECs (Table 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 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 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

7.2.1.2.2 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.

7.2.2 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, US Forest Service, National Park Service, US 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 US 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* (US Forest Service 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 CRF 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 US Forest Service would be incorporated by reference:

- 2,4-D
- Chlorosulfuron
- Clopyralid
- Dicamba
- Glyphosate
- Imazapic
- Imazapyr
- Metsulfuron methyl
- Picloram
- Sethoxydim
- Sulfometuron methyl
- Triclopyr
- Nonylphenol polyethylate (NPE) based surfactants

As a basis for completing "Chemical Profiles" for approving or disapproving refuge PUPs, ecological risk assessments for the following herbicide uses as well as evaluation of risks associated with pesticide degradates and adjuvants prepared by the 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*)

7.2.3 Assumptions for ecological risk assessments

There are a number of assumptions involved with the ecological risk assessment process for terrestrial and aquatic organisms associated with utilization of the US Environmental Protection Agency'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 (US Environmental Protection Agency 2004). As a result, this conservative approach may lead to an overestimation of risk characterization from pesticide exposure.

- Because toxicity tests with listed or candidate species or closely related species are not available, data for surrogate species would be most often used for risk assessments. Specifically, bobwhite quail and mallard duck are the most frequently used surrogates for evaluating potential toxicity to federally listed avian species. Bluegill sunfish, rainbow trout, and fathead minnow are the most common surrogates for evaluating toxicity for freshwater fishes. However, sheep's head minnow can be an appropriate surrogate marine species for coastal environments. Rats and mice are the most common surrogates for evaluating toxicity for mammals. Interspecies sensitivity is a major source of uncertainty in pesticide assessments. As a result of this uncertainty, data is selected for the most sensitive species tested within a taxonomic group (birds, fish, and mammals) given the quality of the data is acceptable. If additional toxicity data for more species of organisms in a particular group are available, the selected data will not be limited to the species previously listed as common surrogates.
- The Kanaga nomogram outputs maximum EEC values that may be used to calculate an average daily concentration over a specified interval of time, which is referred to as a time-weighted-average (TWA). The maximum EEC would be selected as the exposure input for both acute and chronic risk assessments in the screening-level evaluations. The initial or maximum EEC derived from the Kanaga nomogram represents the maximum expected instantaneous or acute exposure to a pesticide. Acute toxicity endpoints are determined using a single exposure to a known pesticide concentration typically for 48 to 96 hours. This value is assumed to represent ecological risk from acute exposure to a pesticide. On the other hand, chronic risk to pesticide exposure is a function of pesticide concentration and duration of exposure to the pesticide. An organism's response to chronic pesticide exposure may result from either the concentration of the pesticide, length of exposure, or some combination of both factors. Standardized tests for chronic toxicity typically involve exposing an organism to several different pesticide concentrations for a specified length of time (days, weeks, months, years or generations). For example, avian reproduction tests include a 10-week exposure phase. Because a single length of time is used in the test, time response data is usually not available for inclusion into risk assessments. Without time response data it is difficult to determine the concentration which elicited a toxicological response.
- Using maximum EECs for chronic risk estimates may result in an overestimate of risk, particularly for compounds that dissipate rapidly. Conversely, using TWAs for chronic risk estimates may underestimate risk if it is the concentration rather than the duration of exposure that is primarily responsible for the observed adverse effect. The maximum EEC would be used for chronic risk assessments although it may result in an overestimate of risk. TWAs may be used for chronic risk assessments, but they will be applied judiciously considering the potential for an underestimate or overestimate of risk. For example, the number of days 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 will require justification and it will not exceed the duration of exposure in the chronic toxicity test (approximately 70 days for the standard avian reproduction study). An alternative to using the duration of the chronic toxicity study is to base the TWA on the application interval. In this case, increasing the application interval would suppress both the estimated peak pesticide concentration and the TWA. Another alternative to using TWAs would be to consider the number of days that a chemical is predicted to exceed the LOC.

- Pesticide dissipation is assumed to be first-order in the absence of data suggesting alternative dissipation patterns such as bi-phasic. Field dissipation data would generally be the most pertinent for assessing exposure in terrestrial species that forage on vegetation. However, these data are often not available and 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 (US Environmental Protection Agency 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 will not likely increase dietary exposure to pesticides. Inclusion of soil into the diet would effectively reduce the overall dietary concentration compared to the present assumption that the entire diet consists 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 will be considered for incorporation into pesticide assessment protocols.
- Exposure to a pesticide may occur from consuming surface water, dew or other water on treated surfaces. Water soluble pesticides have 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 will be incorporated into pesticide risk assessment protocols.
- Risk assessments are based upon the assumption that the entire treatment area would be subject to pesticide application at the rates specified on the label. In most cases, there is potential for uneven application of pesticides through such plausible incidents such as changes in calibration of application equipment, spillage, and localized releases at specific areas in or near the treated field that are associated with mixing and handling and application equipment as well as applicator skill. Inappropriate use of pesticides and the occurrence of spills represent a potential underestimate of risk. It is likely not an important factor for risk characterization. All pesticide applicators are required to be certified by the state in which they apply pesticides. Certification training includes the safe storage, transport, handling, and mixing of pesticides; equipment calibration; and proper application with annual continuing education.
- The 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 95^{th} 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 will tend to overestimate risk characterization. This is particularly evident when wildlife individuals are likely to have selected a variety of food items acquired from multiple locations. Some food items may be contaminated with pesticide residues whereas others are not contaminated. However, it is important to recognize differences in species feeding behavior. Some species may consume whole 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.

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 US 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 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.

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 ($t_{½}$), 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 is usually available for aquatic and terrestrial environments.

Another measure of pesticide persistence is dissipation time (DT_{50}). It represents the time required for 50% 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 is not available, soil half-life data may be used. The average or representative half-life value of most important degradation mechanism will be selected for quantitative analysis for both terrestrial and aquatic environments.

Mobility of a pesticide is a function of how strongly it is adsorbed to soil particles and organic matter, its solubility in water, and its persistence in the environment. Pesticides strongly adsorbed to soil particles, relatively insoluble in water, and not environmentally persistent 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 will dissolve in a known quantity of water. The water solubility of a pesticide is expressed as milligrams of pesticide dissolved in a liter of water (mg/L or 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 (US Geological Survey 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, $t_{½}$, 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 effects pesticide degradation.
- Soil pH would influence chemical reactions that occur in the soil which in turn determines whether or not a pesticide will degrade, rate of degradation, and, in some instances, which degradation products are produced.

Based upon the aforementioned properties, soils most vulnerable to groundwater contamination would be sandy soils with low organic matter. In contrast, the least vulnerable soils would be well-drained clayey soils with high organic matter. Consequently, pesticides with the lowest potential for movement in conjunction with appropriate 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 is persists. In some situations, a hard pan exists above the water table that would prevent pesticide contamination from leaching.

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.

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 is available in references" would be recorded in the profile. Available scientific information would be used to complete Chemical Profiles. Each entry of scientific information would be shown with applicable references.

Completed Chemical Profiles would provide a structured decision-making process utilizing quantitative assessment/screening tools with threshold values (where appropriate) that would be used to evaluate potential biological and other environmental effects to refuge resources. For ecological risk assessments presented in these profiles, the "worst-case scenario" would be evaluated to determine whether a pesticide could be approved for use considering the maximum single application rate specified on pesticide labels for habitat management and croplands/facilities maintenance treatments pertaining to refuges. Where the "worst-case scenario" likely would only result in minor, temporary, and localized effects to listed and non-listed species with appropriate BMPs (see Section 5.0), the proposed pesticide's use in a PUP would have a scientific basis for approval under any application rate specified on the label that is at or below rates evaluated in a Chemical Profile. In some cases, the Chemical Profile would include a lower application rate than the maximum labeled rate in order to protect refuge resources. As necessary, Chemical Profiles would be periodically updated with new scientific information or as pesticides with the same active ingredient are proposed for use on the refuge in PUPs.

Throughout this section, threshold values (to prevent or minimize potential biological and environmental effects) would be clearly identified for specific information presented in a completed Chemical Profile. Comparison with these threshold values provides an explicit scientific basis to approve or disapprove PUPs for habitat management and cropland/facilities maintenance on 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, dessicant, fungicide, fumigant, growth regulator, insecticide, pisicide, 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).

Toxicological Endpoints

Toxicological endpoint data would be collected for acute and chronic tests with mammals, birds, and fish. Data would be recorded for species available in the scientific literature. If no data are found for a particular taxonomic group, then "No data available is references" would be recorded as the data entry. Throughout the Chemical Profile, references (including toxicological endpoint data) would be cited using parentheses (#) following the recorded data.

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 1 in Section 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 1 in Section 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 1 in Section 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 1 in Section 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 1 in Section 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 1 in Section 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 1 in Section 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 1 in Section 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.

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.

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 (US Geological Survey 2000). As pesticide S_w increases, there would be greater potential to degrade water quality through runoff and leaching.

Sw would be used to evaluate potential for bioaccumulation in aquatic species [see **Octanol-Water Partition Coefficient (K_{ow})** below].

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 ($t_{½}$), 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 $t_{½}$ 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 $t_{½}$ ≤100 days, then a PUP would be approved without additional BMPs to protect water quality.
If soil $t_{½}$ >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 $t_{½}$ 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 $t_{½}$ describes the rate for degradation only. As for $t_{½}$, units of dissipation time are usually expressed in days. Field dissipation time would be the preferred data for use to estimate pesticide concentrations in the environment because it is based upon field studies compared to soil $t_{½}$, which is derived in a laboratory. However, soil $t_{½}$ is the most common persistence data available in the published literature. If field dissipation data is 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 $t_{½}$) 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 $t_{½}$, which represents the length of time required for 50% of the deposited pesticide to degrade (completely or partially) in water. Based upon the $t_{½}$ value, aquatic persistence would be categorized as one of the following: non-persistent <30 days, moderately persistent = 30 to 100 days, and persistent >100 days (Kerle et. al. 1996).

Threshold for Approving PUPs:

If aquatic $t_{½}$ ≤100 days, then a PUP would be approved without additional BMPs to protect water quality.
If aquatic $t_{½}$ >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 $t_{½}$ describes the rate for degradation only. As for $t_{½}$, units of dissipation time are usually expressed in days. Based upon the DT_{50} value, environmental persistence in aquatic habitats also would be categorized as one of the following: non-persistent <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 $t_{½}$>30 days, then there would be high potential for a pesticide to bioaccumulate in aquatic species such as fish (US Geological Survey 2000).

Threshold for Approving PUPs:

If there is not a high potential for a pesticide to bioaccumulate in aquatic species, then the PUP would be approved.
If there is a high potential to bioaccumulate in aquatic species (K_{ow}>1,000 or S_w<1 mg/L and soil $t_{½}$>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 (US Environmental Protection Agency 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 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 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 7.2.1.1.2 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 2 in Section 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 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 will 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 4.0 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, US Environmental Protection Agency, Washington, DC. (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, US Department of Agriculture, US Forest Service. (http://www.fs.fed.us/foresthealth/pesticide/risk.htm)

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 will 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 4.0 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, US Environmental Protection Agency, Washington, DC. (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, US Department of Agriculture, US Forest Service. (http://www.fs.fed.us/foresthealth/pesticide/risk.htm)

Chemical Profile

Date:			
Trade Name(s):		**Common Chemical Name(s):**	
Pesticide Type:		**EPA Registration Number:**	
Pesticide Class:		**CAS Number:**	
Other Ingredients:			

Toxicological Endpoints

Mammalian LD_{50}:	
Mammalian LC_{50}:	
Mammalian Reproduction:	
Avian LD_{50}:	
Avian LC_{50}:	
Avian Reproduction:	
Fish LC_{50}:	
Fish ELS/Life Cycle:	
Other:	

Ecological Incident Reports

Environmental Fate

Water solubility (S_w):	
Soil Mobility (K_{oc}):	
Soil Persistence ($t_{½}$):	
Soil Dissipation (DT_{50}):	
Aquatic Persistence ($t_{½}$):	
Aquatic Dissipation (DT_{50}):	
Potential to Move to Groundwater (GUS score):	
Volatilization (mm Hg):	
Octanol-Water Partition Coefficient (K_{ow}):	
Bioaccumulation/Biocentration:	**BAF:`** **BCF:**

Worst Case Ecological Risk Assessment

Max Application Rate (ai lbs/acre - ae basis)	**Habitat Management:** **Croplands/Facilities Maintenance:**
EECs	**Terrestrial (Habitat Management):** **Terrestrial (Croplands/Facilities Maintenance):** **Aquatic (Habitat Management):** **Aquatic (Croplands/Facilities Maintenance):**

Habitat Management Treatments:

Presumption of Unacceptable Risk		**Risk Quotient (RQ)**	
		Listed (T&E) Species	**Nonlisted Species**
Acute	Birds	[0.1]	[0.5]
	Mammals	[0.1]	[0.5]
	Fish	[0.05]	[0.5]
Chronic	Birds	[1]	[1]
	Mammals	[1]	[1]
	Fish	[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 G. Fire Management Plan

FIRE MANAGEMENT PLAN

SOUTHEAST IDAHO NATIONAL WILDLIFE REFUGE COMPLEX

Camas National Wildlife Refuge
Grays Lake National Wildlife Refuge
Bear Lake National Wildlife Refuge
Minidoka National Wildlife Refuge
Oxford Slough Waterfowl Production Area

Pacific Northwest Region

March 2009

United States Department of the Interior
FISH AND WILDLIFE SERVICE
911 NE 11th Avenue
Portland, Oregon 97232-4181

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:
NWRS/NCR/Fire

Memorandum

To: Regional Director, Region 1
Portland, Oregon

From: Regional Chief, National Wildlife Refuge System Carolyn A. Bohan
Portland, Oregon

Subject: Approval of Updated Fire Management Plan for Southeast Idaho National Wildlife Refuge Complex (NWRC)

The Department of Interior policy (910 DM 1-3), and Fish, and Wildlife Service (Service) policy (621 FW 1.1) require that Service lands with burnable vegetation have an approved Fire Management Plan. Southeast Idaho NWRC has updated the fire management plans for all refuges within the Complex. The updated fire management plans continue the range and extent of activities described in previous plans, but has been updated to be consistent with new interagency formatting directives.

Consistent with the February 2009 Fire Management Handbook, the fire management plans have been forwarded for your review and approval.

Please contact Pam Ensley (503) 231-6174 or Brett Fay (503) 872-2756 if you require additional information on these fire management plans.

Attachment

Prepared by: ______________________________ 3-09-09
Lance Roberts, Fire Management Officer — Date
Southeast Idaho National Wildlife Refuge Complex

Submitted By: ______________________________ 3/9/2009
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Southeast Idaho National Wildlife Refuge Complex

Reviewed by ______________________________ 4/1/09
Pam Ensley, Regional Fire Management Coordinator — Date
Pacific Region, U.S. Fish and Wildlife Service

Reviewed by Ben Harrison ______________________________ 5/5/09
Ben Harrison, Division Chief Natural and Cultural Resources — Date
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Reviewed by ______________________________ 5/15/09
Forrest Cameron, Fish and Wildlife Administrator — Date
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Reviewed by Carolyn A. Bohan ______________________________ 5/15/09
Carolyn Bohan, Assistant Regional Director, Refuges — Date
Pacific Region, U.S. Fish and Wildlife Service

Approved: ______________________________ 5/18/09
FOR: Robyn Thorson, Regional Director — Date
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Table of Contents

1.0 Introduction

1.1 Purpose of the Fire Management Plan (FMP)

This plan is written to meet Department and US Fish and Wildlife Service (FWS) requirements that every area with burnable vegetation must have an approved fire management plan (FMP). It complies with a FWS requirement that refuges review and/or revise FMPs at a minimum of five-year intervals or when significant changes are proposed, such as might occur if significant land use changes are made adjacent to FWS lands (621 FW 2).

The goal of wildland fire management is to plan and implement actions that help accomplish the mission of the National Wildlife Refuge System. That 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 (095 FW 3.2).

Completion of a FMP enables the Southeast Idaho National Wildlife Refuge Complex to consider a full range of appropriate suppression strategies and to conduct prescribed fires; without it, prescribed fires cannot be conducted and only wildfire suppression strategies may be implemented.

This FMP identifies and integrates all wildland fire management and related activities. It defines a program to manage wildland fires and to assure that wildland fire management goals and components are coordinated.

1.2 General Description of the Area in the Fire Management Plan

The Southeast Idaho National Wildlife Refuge Complex is comprised of four wildlife refuges and one waterfowl production area. The Complex is located in the southeastern portion of Idaho ranging from Bear Lake NWR on the Utah border to Camas NWR near the Montana border, (Complex map in appendix A). Refuges included in this Fire Management Plan:

- Bear Lake National Wildlife Refuge (NWR)
- Camas NWR
- Grays Lake NWR
- Minidoka NWR and Oxford Slough Waterfowl Production Area (WPA).

The Complex is diverse both ecologically and geographically. Habitats range from low elevations of the Snake River Plain to the high elevation of the inter-montane habitats of the Rocky Mountains. The Complex office is located in Chubbuck, Idaho; each refuge also has an onsite office with the exception of Oxford Slough WPA.

The refuges in the Complex provide 71,331 acres of wetland, grassland, open water and shrub steppe habitats vital to waterfowl and other migratory and resident wildlife of the Inter Mountain West Region. In an area highly impacted by agricultural development, wetlands and shrub steppe habitats on the Complex are extremely significant. Each refuge has a unique component of wildlife depending upon the composition of various habitat types. A significant proportion of the available wetland habitat in Southeast Idaho is found within the boundaries of the Complex.

Management emphasis on the Complex is on biodiversity including migratory waterfowl (nesting Canada geese, ducks and cranes), colonial waterbirds (white-faced ibis, American white pelicans and Franklin gulls), trumpeter swans migratory land birds, and fish (Bonneville cutthroat trout).

1.3 Significant Values To Protect

Key critical values to protect:

- The Complex refuges provide significant waterfowl habitat on the Pacific Flyway.
- The refuges provide important breeding area for sandhill cranes, Canada geese, Franklin's gulls, white-faced ibis, and migratory land birds.
- Each refuge in the Complex is adjacent to a federally listed Community at Risk. This designation identifies wildland/urban interface (WUI) communities within the vicinity of federal lands that are at risk from wildfire. A list of specific Communities at Risk is located in each individual FMU description (3.2 FMU Characteristics).
- Refuge structures.
- The Complex refuges provide important opportunities for visitor use, (bird watching, hunting and fishing).

2.0 Policy, Land Management Planning, and Partnerships

2.1 Implementation of Fire Policy

Specific planning documents, legislation, organizations and associated policies provide guidance for fire management actions described in this FMP, summarized below.

2.1.1 Federal Interagency Wildland Fire Policy

This FMP meets the federal wildland fire management policy by implementing these guiding principles:

- Firefighter and public safety are the first priority in every fire management activity.
- The role of wildland fire as an essential ecological process and natural change agent has been incorporated into the planning process. Federal agency land and resource management plans guiding documents that define the use and desired future condition on federal lands.
- Fire management plans programs, and activities support land and resource management plans and their implementation.
- Sound risk management is a foundation for all fire management activities. Risks and uncertainties relating to fire management activities are understood, analyzed, communicated, and managed as they relate to the cost of either doing or not doing an activity.
- Fire management programs and activities are economically viable, based upon values to be protected, costs, and land and resource management objectives.
- Fire management plans and activities are based upon the best available science.
- Fire management plans and activities incorporate public health and environmental quality considerations.
- Federal, state, tribal, local, interagency, and international coordination and cooperation are essential.
- Standardization of policies and procedures among federal agencies is an ongoing objective supported in this FMP.

2.1.2 National Fire Plan

This FMP meets the policy and direction criteria in the 2001 National Fire Plan because it emphasizes the following primary goals of the 10 Year Comprehensive Strategy and Cohesive Strategy for Protecting People and Sustaining Natural Resources:

- Improving fire prevention and suppression.
- Reducing hazardous fuels.
- Restoring fire-adapted ecosystems.
- Promoting community assistance.

2.1.3 Department of Interior (DOI) Fire Policy

This FMP incorporates and adheres to DOI policy stated in 620 DM 1 by giving full consideration to use of wildland fire as a natural process and tool during the land management planning process and by providing for the following:

- Wildland fires, whether on or adjacent to lands administered by the Department, which threaten life, improvements, or are determined to be a threat to natural and cultural resources or improvements under the Department's jurisdiction, will be considered emergencies and their suppression given priority over other Departmental programs.
- Bureaus shall cooperate in the development of interagency preparedness plans to ensure timely recognition of approaching critical wildland fire situations; to establish processes for analyzing situations and establishing priorities, and for implementing appropriate management responses to these situations.
- Bureaus will enforce rules and regulations concerning the unauthorized ignition of wildland fires, and aggressively pursue violations.

2.1.4 U.S. Fish and Wildlife Service Fire Policy

By addressing the range of potential wildland fire occurrences and including a full range of appropriate management responses, this FMP meets FWS wildland fire policy. It is consistent with the FWS *Fire Management Handbook* and the *Interagency Standards for Fire and Fire Aviation Management Operations*, which are supplemental policy.

This plan affirms these key elements of FWS fire policy (621 FW 1):

- Firefighter and public safety are the first priority of the wildland fire management program and all associated activities.
- Only trained and qualified fire managers and agency administrators will be responsible for wildland fire management program activities.
- Only trained and certified employees will participate in the wildland fire management program activities, and noncertified employees will provide needed support as necessary.
- All interagency partners, to the extent practicable, should be involved with fire management planning, preparedness, wildfire and prescribed fire operations, monitoring, and research.
- The responsible agency administrator has coordinated, reviewed, and approved this FMP to ensure consistency with approved land management plans, values to protect, and natural and cultural resource management plans and that it addressed public health issues related to smoke and air quality.
- Fire, as an ecological process, has been integrated into resource management plans and activities on a landscape scale, across agency boundaries, based upon the best available science.

- Wildland fire is used to meet identified resource management objectives and benefits when appropriate.
- Prescribed fire and other treatments will be employed whenever they are the appropriate tool to reduce hazard fuels and the associated risk of wildfire to human life, property, and cultural and natural resources and to manage FWS lands for habitats as mandated by statute, treaty, and other authorities.
- Appropriate management response will consider firefighter and public safety, cost effectiveness, values to protect, and natural and cultural resource objectives.
- Staff members will work with local cooperators and the public to prevent unauthorized ignition of wildfires on our lands.

2.2 Land/Resource Management Policy

2.2.1 Agency Land Management Documents

The CCP process was started at Minidoka NWR in 2008; Camas, Grays Lake, Bear Lake, and Oxford Slough are scheduled to start in 2009. Until the CCP for Complex refuges is completed interim management guidance from existing land management documents will be used.

Habitat management direction from other Complex Land Management Documents was used to develop this FMP. Other documents include:

- 2007 draft Habitat Management Plan for Bear Lake NWR and Oxford Slough WPA.
- 2006 draft Habitat Management Plan for Minidoka NWR.
- 1982 Master Plan and 1996 Grassland Management Environmental Assessment for Grays Lake NWR.
- 1995 Refuge Management Plan for Camas NWR.

2.2.2 Compliance with Regulatory Acts

Threatened and Endangered Species Compliance

- A 2007 Intra-Service Section 7 Biological Evaluation for normal refuge operations including prescribed fire and mechanical fuels reduction projects has been signed by the Complex Project Leader for each of the refuges; copies are on file at the Complex headquarters.

Cultural Resource Compliance

- In order to comply with National Historic Preservation Act of 1966 and Archeological Resources Preservation Act of 1979 regulations, a Request for Cultural Resource Compliance will be completed on a project by project basis and submitted to the regional office. The completed Cultural Resource Compliance documents are on file at individual refuge headquarters.

NEPA Compliance

- A Categorical Exclusion for fire management operations (wildland fire suppression, prescribed fire, and mechanical fuels reduction) was signed by the Complex Project Leader and attached in Appendix C This Categorical Exclusion applies to all five Complex refuges and will be reviewed annually.

Smoke Management Compliance

- Referenced in section 4.2.1.5

2.3 Fire Management Partnerships

2.3.1 Internal Partnerships

An interdisciplinary team, comprised of Complex staff members, is responsible for reviewing this fire management plan and making recommendations concerning wildland fire management projects and issues.

2.3.3 External Partnerships

Federal Cooperators:
The Complex partners with the USDI Bureau of Land Management (BLM), USDA Forest Service (USFS) and the Bureau of Indian Affairs (BIA) to coordinate fire suppression activities, dispatch services, and implementation of prescribed fire projects. The Complex refuges fall into two different interagency fire dispatch zones in southern Idaho. Camas, Grays Lake, Bear Lake, and Oxford Slough fire operations are coordinated through the Eastern Idaho Interagency Fire Center, (EIIFC); Minidoka fire operations are coordinated with the South Central Idaho Interagency Dispatch Center, (SCIIDC). The Grays Lake NWR fire crew and Complex FMO are dispatched through EIIFC. Interagency Agreements with EIIFC and SCIIDC are attached in Appendix F

Fire Planning Analysis:
Federal land management agencies have been directed to implement Phase 2 of Fire Planning Analysis (FPA) beginning in fiscal years 2008 and 2009. FPA is a fire management workload analysis system that uses simulation and modeling tools to project fire workload for Fire Planning Units (FPUs). Interagency cooperation is fostered to meet National Fire Plan goals and specific agency fire program budget needs. The complex refuges (Camas, Grays Lake, Bear Lake, Oxford Slough) are included in the Southeast Idaho FPU; Minidoka NWR is in the South Central Idaho FPU. Federal partners, including the BLM, USFS, BIA work collaboratively with the Service to implement this plan and meet National Fire Plan goals for wildland fire protection, landscape restoration, and hazard fuel mitigation measures.

Idaho State Fire Plan Working Group:
The Idaho State Fire Plan Working Group (ISFPWG) is a multi-agency collaborative body charged with assisting counties with their County Wildfire Protection Plans and their associated countywide working groups, dissemination of information, and oversight and prioritization of grant assistance programs in order to facilitate the implementation of the National Fire Plan in Idaho. The Regional Fire Outreach Coordinator housed at Deer Flat represents the FWS as a part of this group. They participate in ISFPWG subcommittees as appropriate. Subcommittees include those focused on fire education, restoration, and communication to promote state-wide projects and emphasis items.

Idaho State Fire Plan Working Group:
The Complex coordinates with the Federal and State members of the Idaho State Fire Plan Working Group ISFPWG to identify, fund, and implements fuels reductions projects in Wildland Urban Interface (WUI) areas. Each county in Idaho has developed a County Wildfire Protection Plan (CWPP) that identifies potential fuel reduction opportunities/area. The CWPP are posted at this website Idaho Department of Lands CWPP.

Bureau of Reclamation:
A memorandum of understanding exists between Minidoka NWR and the Bureau of Reclamation (BOR) to outline joint responsibilities for the operation and management of the lands and waters within Lake Walcott at the Refuge. This MOU is on file at the Complex office.

3.0 Fire Management Unit Characteristics

A fire management unit (FMU) is an area that shares common objectives, physiological/biological/social characteristics and constraints, that result in desired conditions as stated in land management plans (i.e., CCP, HMP), which set it apart from the characteristics of an adjacent FMU.

Considering fire history, occurrence, staff limitations, and the characteristics stated above, the wildland fire program complexity at the Complex is moderate. In the Complex, each refuge will be a separate Fire Management Unit.

3.1 Area Wide Management Considerations

The following sections addresses management considerations for the FMUs including fire management objectives, constraints, fuels, fire regime and condition classes, standards, fire potential of major vegetation types, and burned area rehabilitation.

3.1.1 Management Goals, Objectives and Constraints from CCPs and other planning documents

The planning process for the Complex CCPs is scheduled to start in 2009; management goals and objectives were obtained from existing refuge plans. The following general fire management goals and objectives have been identified from the pre-CCP process.

To the extent practicable, use prescribed fire in conjunction with water management, grazing, mowing, and/or other mechanical manipulations and chemical applications, on emergent wetland, woody riparian, herbaceous upland and/or wet meadow vegetation, in order to provide desirable vegetation species composition and/or structure, including, but not limited to:

- Use hazardous fuels treatments to reduce the threat of wildfire to adjacent communities and Refuge infrastructure.
- Decreasing noxious weeds.
- Decreasing dense emergent wetland plants.
- Increasing wetland water: vegetation interspersion ratios (20-60% open water).
- Restoring native shrub communities.
- Removing densely matted herbaceous vegetation and/or reducing dead or decadent woody vegetation so as to improve ecological conditions for native plants and native plant communities and the resident and migratory wildlife that depend on them.

3.1.2 Management Goals, Objectives, and Constraints from other Sources

The following operational standards are pertinent to the Complex, as found in the FWS manual (095 FW 3):

- Manage fire suppression to minimize risks to firefighter and public safety.
- An initial action and an appropriate management response are required for every wildfire on or threatening refuge lands.
- The range of appropriate management responses to wildfires may include direct or indirect attack of high and/or low intensities or surveillance and monitoring to ensure fire spread will be limited to a designated area.
- Reduce and maintain fuels in WUI areas to provide for public and firefighter health and safety.

- Reduce and maintain fuels in non-WUI areas to provide for firefighter health and safety and to protect habitats critical to endangered species, migratory birds, and ecosystem integrity.
- Use prescribed fire as a tool to restore ecosystem integrity and endangered species habitat.
- Prepare and implement an effective fire prevention plan to minimize unwanted fires.
- Investigate all unplanned human-caused fires.
- Retardants and foams will not be used within 300 feet of any waterway.
- Minimize and, where necessary, mitigate human-induced impacts to resources, natural processes, or improvements attributable to wildland fire activities.
- Ground disturbed by suppression activities will be rehabilitated.
- Heavy equipment use will be closely monitored in designated areas to minimize impacts on cultural resources.
- Heavy equipment use will be closely coordinated with the Refuge Manager or resource advisor to limit habitat damage. Due to soft ground conditions many areas of the Complex are unsuitable to heavy equipment usage.
- Prevent the further spread of invasive plants.
- Maintain close working relationship with interagency partners to accomplish wildland fire suppression and prescribed fire treatments.
- Maintain Intergovernmental Agreements with interagency partners for dispatch services.
- Promote public understanding of refuge fire management programs and objectives.

3.1.2.1 Cost Effectiveness

Maximizing the cost effectiveness of any fire operation is the responsibility of all involved, including those that authorize, direct, or implement those operations. Cost effectiveness is the most economical use of the resources necessary to accomplish project/incident objectives. Accomplishing these objectives safely and efficiently will not be sacrificed for the sole purpose of "cost saving". Care will be taken to ensure that expenditures are commensurate with values to be protected. Many factors outside of the biophysical environment may influence spending decisions, including those of the social, political, and economic realms. The following tools will be used to provide information to make the most cost effective decision possible:

- Employ state-of-the-art decision support tools
- Provide a clear description of Refuge objectives in this Fire management Plan to aid in alternative development
- Through cost-share agreements, distribute the decision process to all parties involved in wildland fire management

3.1.3 Common Characteristics of the Fire Management Units

Climate

The southeast Idaho climate can be described as semi-arid. The area climate varies between that of the Snake River Plain (SRP) and the higher elevation Eastern Mountain Region (EMR). Minidoka and Camas refuges are located in the SRP; Grays Lake, Bear Lake, and Oxford Slough are located in the EMR. The winter weather at the Complex refuges is characterized by below freezing temperatures and snow covered ground. Spring months are usually wet and windy; with weather conditions fluctuating quickly at times. Summer may begin suddenly with a rapid change to warm and dry weather. Thunderstorms are common from late spring through the summer months. These storms often produce very localized precipitation. Fall weather can be characterized by cooler/dry days. The yearly precipitation ranges from 9 inches in the SRP to over 15 inches in the EMR; average snow fall is 27 inches-SRP and 49-61 inches-EMR.

Information in the climate tables below was gathered from weather stations in Hamer and Soda Springs Idaho and BLM/USFS/FWS RAWS stations in eastern Idaho.

Snake River Plain Climate

	Spring	**Summer**	**Fall**
Average Max Temp (F)	59	87	62
Average Min Temp (F)	27	47	26
Average Mean Relative Humidity (%)	51	38	46
Average Min Relative Humidity (%)	16	11	14

Southeast Idaho Eastern Mountain Region Climate

	Spring	**Summer**	**Fall**
Average Max Temp (F)	54	83	59
Average Min Temp (F)	26	44	26
Average Mean Relative Humidity (%)	50	35	43
Average Min Relative Humidity (%)	22	12	15

See Appendix D for additional southeast Idaho climate charts and graphs.

Vegetation
The vegetation/habitat for the Complex refuges is described in the individual FMU Characteristics with acreage and percentages. The Complex vegetation types can be generally described as Marsh (FM 3), Grasslands (FM 1), and Shrub (FM 2/6).

Bulrush Marsh – FM 3

Grasslands – FM 1

Sagebrush Steppe - Shrub FM 2/6

Fire behavior outputs in the table below were from the BehavePlus 3.0.2 program. In this model, fires are assumed to be spreading as a series of steady state ignitions through uniform fuels under uniform weather conditions. Spread is also assumed to be from surface fire only. The fire behavior outputs are modeled to represent a potential summer fire (July/August). This fire behavior would be considered to be high to extreme. Weather data used in the modeling is 20 year data from BLM/USFS/FWS RAWS stations. Weather inputs to the BehavePlus runs: July, Temp 70-89, RH 11-38, 1-hr fuel moisture/FDFM 2/5%, 10-hr fuel moisture 7%, 100-hr fuel moisture 8%, live herbaceous moisture 65%, wind speed 5/15 mph, time of day 1400, slope 0-5%.

Fire Behavior Outputs by NFFL Fuel Models

Fuel Model	**Rate of Spread (ch/hr)**	**Flame Length (ft)**
1	99-665	5-13
2	42-388	7-21
3	129-741	14-35
6	37-207	6-15

Normal Fire Season

The normal fire season for the Complex refuges is March to October. The majority of the fires have occurred in July and August. The lower elevation refuges of Camas and Minidoka experience earlier season fires than higher elevation refuges (Grays Lake and Bear Lake). After snow melt in early spring Camas and Minidoka can experience a short potential for fire starts before the vegetation greens up, (during the drought year of 2007 Camas NWR vegetation did not green up staying cured all summer). The vegetation usually cures out at Camas and Minidoka by the end of June or early July. Due to higher elevation and snow pack the grassland vegetation at Bear Lake and Grays Lake refuges usually does not cure out until the end of July or early August. The bulrush vegetation at all the Complex refuges does not cure out until the end of September unless drought influenced.

Wildfire History

From 1997 to 2007 the Complex refuges has experienced 24 wildfires. The majority and largest fires have occurred in the sagebrush steppe habitat at Minidoka NWR. Most of the fire starts have been from lightning. See fire history spreadsheet and bar graph in Appendix E

Prescribed Fire History

From 1997 to 2007 41 prescribed fire (RX) treatment units have been burned at the Complex refuges for 10,141 acres. The majority of the RX treatments have been accomplished at Grays Lake and Bear Lake refuges. Due to its smaller acreage the RX units at Camas NWR have been smaller in size. Minidoka is the only complex refuge where RX treatments have not been initiated, mainly due to the amount of sagebrush habitat that has been lost to wildfires. Most of the RX treatments have been in marsh habitat with a smaller amount in the Complex wet and dry meadows. See RX history spreadsheet in Appendix E

RX treatments 1997 to 2007

Refuge	**RX Treatments**	**Acreage**
Grays Lake NWR	14	3,447
Bear Lake NWR	13	5,272
Camas NWR	12	795
Oxford Slough WPA	2	117
Totals	**41**	**10,141**

Mechanical Fuel Reduction Treatments

31 mechanical fuel reductions treatments have been accomplished at the Complex refuges from 1997 to 2007. The treatments include a mixture of haying, grazing, mowing, chemical, and tree removal to reduce hazardous fuel loading adjacent to refuge boundaries. Most of the treatments have taken place in refuge grasslands. Mow lines adjacent to refuge roads are maintained yearly to enhance potential fire control lines.

Mechanical Fuel Reduction treatments 1997 to 2007

Refuge	**Treatments**	**Acreage**
Grays Lake NWR	8	2,654
Bear Lake NWR	6	2,749
Camas NWR	10	1,166
Oxford Slough WPA	2	725
Minidoka NWR	5	745
Totals	**31**	**8,039**

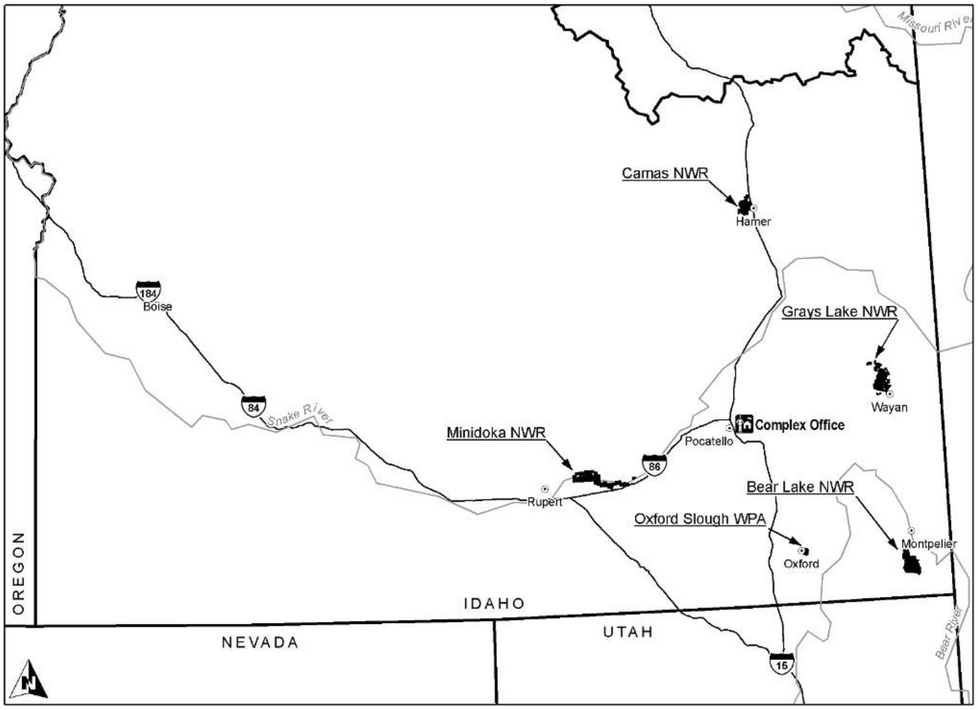
3.2 Fire Management Units

Fire Management Units (FMUs) are areas which have common wildland fire management objectives and strategies, are manageable units from a wildland fire standpoint, and can be based on natural or manmade fuel breaks. In the Southeast Idaho Complex, each of the five individual refuges will be a separate Fire Management Unit. All five refuges are located in southeast Idaho with similar vegetation, (bulrush marsh, grasslands, sagebrush steppe), mission, wildlife and terrain. The wildfire occurrence has been similar, (Camas and Minidoka refuges located in the Snake River Plains do experience more fires than the other three higher elevation refuges). The five refuges are managed as a Complex and are suited to be included in one Fire Management Plan, identified as separate FMUs.

Fire Management Units in the Southeast Idaho NWRC

FWS Fire Management Units within the FMP	Total Acres	Burnable Acres
Bear Lake NWR	18,051	13,026
Camas NWR	10,578	9,948
Grays Lake NWR	20,125	18,655
Minidoka NWR	20,699	9,399
Oxford Slough WPA	1,878	1,810
Totals	**71,331**	**52,838**

Southeast Idaho NWRC Location Map



3.2.1 Bear Lake FMU Characteristics

Bear Lake NWR includes the Bear Lake Unit and the Thomas Fork unit, (map in appendix A). The Bear Lake unit consists of 18,051 acres of open water, marsh, uplands, grasslands, low wet meadows, and steep shrub covered slopes located north of Bear Lake and about seven miles south of Montpelier. The refuge was established in 1968 by Public land Orders 4415 and 4545, which withdrew 16,960, acres from the public domain for the creation of the refuge. Land purchases have added an additional 1,091 acres. The land was withdrawn to protect and improve the habitat for the western Canada goose and other waterfowl as well as the greater sandhill crane. The mission of the refuge has not changed although greater emphasis is now on redhead and canvasback duck production. Trumpeter swans and colonial nesting species, particularly white-faced ibis are receiving more management attention.

The Thomas Fork unit, (TFU) consists of 1,015 acres of open water, marsh, and low meadows located adjacent to the Wyoming border in the Gentile Valley just above where the Thomas Fork joins the Bear River. This unit was acquired in fee title from the Farmers Services Administration in 1996. The land was added to the refuge because it represents excellent sandhill crane habitat and is especially important to cranes on their migrations through the area in the spring and fall. TFU provides important habitat for a variety of wildlife in an area dominated by agriculture. An active farming program is maintained on uplands for grains that are the main food source for sandhill cranes when occupying the refuge. The Thomas Fork River is used by Bonneville cutthroat trout.

A large percentage of the vegetation at Bear Lake NWR consists of emergent (primarily bulrush) residual cover in the large marsh. The main marsh area of the refuge is approximately 16,000 acres in size. The main marsh is by bordering wet meadows which consist of Juncus spp., Carex spp., and a variety of water tolerant grasses. Many of the wet meadows are hayed to short grass stubble during the summer reducing potential fire behavior. The dry meadow grass species include: saltgrass, alkali sacaton, several species of wheatgrass, and basin wildrye. The shrub species are comprised of sagebrush and greasewood; these are scattered in small areas throughout the refuge with the largest concentration located on the steep slopes of Merkley Ridge on the east side of the refuge. The riparian species is mostly comprised of willow; most of which is mainly located along the Rainbow Canal with a few other isolated pockets scattered across the refuge.

Fuel Model Composition Bear Lake NWR

Marsh	FM 3	11,303 acres	59%
Dry Meadow	FM 1	1,317 acres	7%
Wet Meadows	FM 1	943 acres	5%
Shrub	FM 2	376 acres	2%
Riparian	FM 4	90 acres	1%
Open Water		5,025 acres	26%

3.2.2 Bear Lake FMU Fire Environment

The biggest factor affecting fire management operations at the refuge is fire vehicle access to the marsh lands. The majority of the refuge lands consist of wetland marsh restricting conventional fire vehicles to dikes, roads and dry meadows. The Complex has three amphibious vehicles outfitted with slip-on tank/pump units which can provide limited fire suppression in the wetlands. The refuge has numerous open water areas and several roads which break up the vegetation continuity and provide opportunities for fire control lines.

The marshland vegetation is sub-irrigated and green most of the year; the emergent bulrush usually does not cure out until freezing temperatures in the fall top kill the plants. The fire potential and spread in the bulrush marsh can usually be considered low until vegetation cures out. The biggest factor in bulrush fire behavior is wind speed and direction.

The wet and dry hay meadows surrounding the marsh are also sub-irrigated. The drier meadows usually cure out in July; wet meadows may not cure out until August. Wind speed and direction are also a big factor in grassland fire behavior.

Private property borders most of the refuge, this property is mostly ranchland and hay fields which are grazed heavily during fall and winter months. The federally listed Communities at Risk bordering Bear Lake refuge include Dingle, Paris and Bloomington, Idaho. Forest Service lands border the southeast section of the refuge in the Merkley Ridge area. This section of the refuge is where the majority of human caused fire has started.

3.2.3 Bear Lake FMU Objectives and Constraints

- Use prescribed fire and mechanical manipulation to annually simulate natural environmental processes (return to early successional status) in emergent wetland and wet meadow habitats.
- Eliminate or control invasive plant species by using a combination of mechanical, prescribed fire, and chemical treatments.
- FMU Appropriate Management Response objectives include managing wildfires to meet fuels and habitat objectives and to benefit migratory bird habitat.

- The waterfowl nesting season at the refuges ranges from mid-April to late summer. Prescribed fire and mechanical fuel reduction treatments will not usually take place during this time to avoid disturbing nesting habitat.
- Due to constraints such as nesting season, water level fluctuation, and fire season the refuge will have two prescribed burn windows in spring and fall. As determined from past years burn experience the approximate burn windows will be; Spring - March 1 to April 15; Fall – September 20 to October 30. During these windows the above constraints can be mitigated and vegetation is cured out enough to meet prescribed burn objectives.
- General Appropriate Management Response strategy (AMR) – AMR strategy will range from full suppression to confine contain on isolated bulrush island surrounded by water. The majority of the refuge will use AMR full suppression, especially adjacent to private property. However there are some isolated pockets of bulrush in the Mud Lake area (southeast corner of the refuge) that are surrounded by water. These areas would be very difficult to access for fire suppression and a potential wildfire could provide a resource benefit.

3.2.4 Bear Lake FMU Values to Protect

- High priority will be given to any wildfire on the refuge threatening private property. The Federally designated Communities at Risk of Dingle, Paris, and Bloomington are adjacent to the refuge.
- The northeast Mud Lake colonial nesting areas used by white-faced ibis, Franklin’s gulls, other herons and egrets.
- Refuge structures are listed in Appendix XX.
- High voltage power lines running across the southwest corner of the refuge.

3.3.1 Camas FMU Characteristics

The refuge was established in 1937 by Executive Order 7720. The stated purpose for the refuge is to provide “a refuge and breeding ground for migratory birds and other wildlife”. Trumpeter swan nesting and sage grouse habitat have been receiving more attention in recent years.

Camas NWR consists of 10,578 acres of open water, marsh, upland grasslands and shrub steppe located in the Snake River Plain 24 miles north of Idaho Falls. About half of the refuge's 10,578 acres are lakes, ponds, and marshlands. The remainder consists of grass-sagebrush uplands and meadows. The management of sage grouse habitat has been receiving increased attention on the refuge in recent years. Camas Creek flows for 9 miles through the length of the refuge and is the source of water for many lakes and ponds. Several wells on the refuge also provide water for wildlife during the summer.

The vegetation/habitat types at Camas are broken down into the following:

- Sagebrush/grassland - in climax stage, the site is dominated by basin big sagebrush, arrowleaf balsamroot, Indian ricegrass and needle/thread grass. Approximately 1,200 acres has been seeded with crested wheatgrass; rabbitbrush, knapweed and various weed species are also present.
- Wet Meadow - dominated by Baltic rush and various sedges.
- Marsh - dominated by hardstem bulrush and broadleaf cattail.
- Semiwet Meadow – dominated by saline tolerant plants such as inland saltgrass, alkali bluegrass and alkali sacaton. This habitat appears as narrow strips between the Wet Meadow and Marsh sites.

- Riparian – dominated by willows and some cottonwoods; the majority of the willow are located in a 46 acre patch adjacent to Rays Lake in the southern portion of the refuge. A narrow band of willow grows along sections Camas Creek. The cottonwood trees mostly grow in the refuge headquarters area bordering Camas Creek.

Fuel Model Composition for Camas NWR

Sagebrush/grasslands	FM 2/6	3,633 acres	34%
Wet Meadow	FM 1	2,956 acres	28%
Marsh	FM 3	2,401 acres	23%
Semiwet Meadow	FM 1	853 acres	8%
Riparian	FM 4	105 acres	1%
Open water/mud flats		630 acres	6%

3.3.2 Camas FMU Fire Environment

The fire risk at Camas NWR is considered moderate to high due to its location amid ranches, private dwellings and the numerous refuge facilities. The Upper Snake River Plain has a history of large wind driven fires (5,000 to 10,000 acres). Private property borders two thirds of the refuge; BLM land borders the west side of the refuge. Numerous private residences are located on the refuge boundary in the northeast section. The federally listed Community at Risk of Hamer, Idaho, borders the refuge on the southeast side. The refuge has numerous gravel and two-track roads which break up the vegetation continuity.

The majority of the habitat at the refuge is grasslands which cure out in early to mid-summer. During the drought year of 2007 due to the lack of snow and spring rain fall the dryer portions of refuge grassland did not green-up remaining cured all season. The invasion of cheat grass to the sagebrush habitats has increased the fire frequency and intensity.

3.3.3 Camas FMU Objectives and Constraints

- Use prescribed fire and mechanical manipulation to annually simulate natural environmental processes (return to early successional status) in emergent wetland and wet meadow habitats.
- Eliminate or control invasive plant species by using a combination of mechanical, prescribed fire, and chemical treatments.
- FMU Appropriate Management Response objectives include managing wildfires to meet fuels and habitat objectives.
- The waterfowl nesting season at the refuge ranges from mid-April to late summer. Prescribed fire and mechanical fuel reduction treatments will not usually take place during this time to avoid disturbing nesting habitat.
- Due to constraints such as nesting season, water level fluctuation, and fire season the refuge will have two prescribed burn windows in spring and fall. As determined from past years burn experience the approximate burn windows will be; Spring - March 1 to April 15; Fall – September 20 to October 30. During these windows the above constraints can be mitigated and vegetation is cured out enough to meet prescribed burn objectives.
- AMR strategy – unplanned fire will be contained at the smallest size possible due to proximity to adjacent private property and structure. Some areas of the refuge (bulrush marsh) are not conducive to off road fire vehicle access; in these areas a refuge road may will be utilized for a containment line.

3.3.4 Camas FMU Values to Protect

- High priority will be given to any wildfire on the refuge threatening private property. The Federally designated Community at Risk of Hamer is adjacent to the refuge.
- Sagebrush/grassland habitats located on the north and west side of the refuge.
- Sensitive areas of the Refuge are the riparian habitat along Camas Creek associated with headquarters (old growth cottonwood and black willow trees).
- The peregrine hack tower; headquarters buildings; refuge residences; and the irrigation pumps.
- Numerous private residences along the northeast refuge border.
- Cultural resource sites (documented at refuge headquarters).

3.4.1 Grays Lake FMU Description

Grays Lake NWR was established in 1965 to protect and restore habitat for waterfowl production, sandhill cranes, and other wildlife. The total area within the proposed refuge boundary is 32,825 acres. Currently 20,125 acres are controlled by the Service through fee-title, use agreements and land purchases. Approximately 9,000 acres of land surrounding the marsh shore line is Unadjudicated land; the Service is currently negotiating with the adjacent private land owners and the State Of Idaho to get this issue resolved. Bear Island (approximately 401 acres) is located in the middle of the Grays Lake marsh; this land is controlled by the BIA.

The refuge's goals are to enhance natural ecosystem functions to support a diversity of water fowl birds and other wildlife. The refuge provides significant breeding area for sandhill cranes, Canada geese, Franklin's gulls, and white-faced ibis.

Grays Lake NWR is located on the western edge of the Greater Yellowstone Ecosystem in Bonneville and Caribou Counties, Idaho. Grays Lake lies in a relatively remote and sparsely populated high altitude (6386 ft) mountain valley. Grays Lake is actually a 22,000 acre shallow marsh with dense vegetation (bulrush and cattail) and little open water. Caribou Mountain borders the refuge to the east, at 9803 feet it is the highest point within the watershed.

The refuge is located in a transitional zone between Great Basin vegetation (south) and Rocky Mountain vegetation (north). Vegetation within approved refuge boundary consists of:

- Marsh - dominated by hardstem bulrush and broadleaf cattail.
- Wet/Dry Meadow – consists of over 170 species of grasses, sedges and forbs.
- Shrub - 17 species of shrubs.
- Riparian - 7 species of trees.

Fuel Model Composition for Grays Lake NWR

Bulrush/Cattail	FM 3	13,951 acres	69%
Wet/Dry Meadow	FM 1	4,504 acres	23%
Riparian	FM 8	100 +/- acres	<1%
Shrub	FM 2	100 +/- acres	<1%
Open water/ mud flats		1,470	8%

3.4.2 Grays Lake FMU Fire Environment

The biggest factor affecting fire management operations at the refuge is fire vehicle access to the marsh lands. As mentioned above the majority of the refuge lands consists of a continuous wetland marsh with only a couple of short dikes and canals. The Complex has three amphibious vehicles outfitted with slip-on tank/pump units which can provided limited fire suppression in the wetlands. A large wind driven fire in the bulrush could not safely be suppressed by direct attack.

The marshland vegetation is sub-irrigated and green most of the year; the emergent bulrush usually does not cure out until freezing temperatures in the fall top kill the plants. The fire potential and spread in the bulrush marsh can usually be considered low until vegetation cures out. The biggest factor in bulrush fire behavior is wind speed and direction.

The wet and dry hay meadows surrounding the marsh are also sub-irrigated. The drier meadows usually cure out in August; wet meadows may not cure out until September. Wind speed and direction are also a big factor in grassland fire behavior.

Private property with numerous structures (residences, barns, and out buildings) border the east and south sections of the refuge. The federally listed Community at Risk of Wayan, Idaho, is southeast of the refuge.

3.4.3 Grays Lake FMU Objectives and Constraints

- Use prescribed fire and mechanical manipulation to annually simulate natural environmental processes (return to early successional status) in emergent wetland and wet meadow habitats.
- Eliminate or control invasive plant species by using a combination of mechanical, prescribed fire, and chemical treatments.
- FMU Appropriate Management Response objectives include managing wildfires to meet fuels and habitat objectives.
- The waterfowl nesting season at the refuge ranges from mid-April to late summer. Prescribed fire and mechanical fuel reduction treatments will not usually take place during this time to avoid disturbing nesting habitat.
- Due to constraints such as nesting season, water level fluctuation, and fire season the refuge will have one prescribed burn window in the fall. As determined from past years burn experiences the approximate burn window will be September 20 to October 30. During this window the above constraints can be mitigated and vegetation is cured out enough to meet prescribed burn objectives.
- AMR strategy for the refuge will range from full suppression to confine/contain and monitor. Unplanned fires adjacent to private property and structures will be contained at the smallest size possible if practical. As mentioned above the majority of the refuge lands consists of a continuous wetland marsh with only a couple of short dikes and canals. The Complex has three amphibious vehicles outfitted with slip-on tank/pump units which can provided limited fire suppression in the wetlands. A large fire wind driven fire in the bulrush could not safely be suppressed by direct attack. Depending on current weather and fuels conditions an AMR confine/contain/monitor strategy may be used for fires in the marsh.

3.4.4 Grays Lake FMU Values to Protect

- High priority will be given to any wildfire on the refuge threatening private property. The Federally designated Community at Risk of Wayan is adjacent to the refuge.
- Herman, Eagle and Gravel creeks contain limited riparian vegetation (primarily willows) that would be damaged by fire.
- A large mixed nesting colony of white-faced ibis and Franklin’s gulls exists in the south-central portion of Gray=s Lake marsh.
- Structures located at the refuge headquarters.

3.5.1 Minidoka FMU Description

Minidoka NWR was established as a refuge and breeding ground for migratory birds and other wildlife. Minidoka NWR has been designated as an Important Bird Area (IBA) of global importance for its colonial nesting bird populations and for the numbers of molting waterfowl. This program identifies areas that have high value for birds throughout the world.

Minidoka NWR is an overlay refuge on lands withdrawn by the Bureau of Reclamation located on the Snake River Plain in south-central Idaho, 12 miles northeast of the town of Rupert. The primary feature is Lake Walcott, the reservoir formed by the construction of the Minidoka Dam in 1906. The dam, power plant, irrigation canals, and lake water levels are all managed by the Bureau of Reclamation (BOR). Adjacent to the dam and refuge headquarters is Lake Walcott State Park which is administered by the Idaho Department of Parks and Recreation (IDP&R). The park provides the public with picnic, camping and boat launch facilities. The project land and water areas are managed as a refuge for wildlife by the FWS.

Minidoka Refuge extends upstream approximately 25 miles from the Minidoka Dam along both shores of the Snake River, encompassing a total of 20,699 acres, of which 11,300 acres are the open water of Lake Walcott, the Snake River, and some small marsh areas. The remaining 9,399 acres of upland are classified as sagebrush-grass (3,519 acres) and grassland (5,880 acres).

- Sagebrush-grasslands - Vegetative types are predominantly sagebrush-grass and short bunchgrass complexes. The overstory is composed primarily of sagebrush and rabbitbrush with the understory mainly cheatgrass, crested wheatgrass, and native grasses and forbs.
- Grasslands – include several large seedings of crested wheat grass; Native grasses commonly found include western wheatgrass, Indian ricegrass, Sandberg's bluegrass, bottlebrush squaretail, needle-and-thread, and green needlegrass.
- Riparian - there are a few areas with sizable patches of riparian habitat, but for the most part the riparian zone is narrow and linear, in most places only 1 tree wide where it goes from open water to basalt rock in only a few feet. Shrub species include skunkbush sumac, Wood's rose, and golden currant. Mid sized species is primarily coyote willow with some skunkush sumac. Taller species include eastern cottonwood, peachleaf and Pacific willows, Russian olive, green ash, and Chinese elm.
- Marsh – small pockets of bulrush and cattails located in shallow bays and coves, and in the two diked water units. In some areas it is a narrow fringe along the shoreline.

Fuel Model Composition for Grays Lake NWR

Grassland	FM 1	5,880 acres	28%
Sagebrush/Grass	FM 2/6	3,519 acres	18%
Marsh	FM 3	NA	<1%
Riparian	FM 4	NA	<1%
Open Water		11,300 acres	54%

3.5.2 Minidoka FMU Fire Environment

Minidoka NWR is located in the Snake River Plain which has a history of large wind driven fires. The majority of the large fires at the refuge have started from lightning. The invasion of cheat grass has increased the fire occurrence and fire size in the sagebrush habitat. BLM lands border most of the refuge, the majority of large fire experienced at the refuge have burned on both FWS and BLM lands. The refuge has experienced fires from spring to fall with the majority occurring in mid-summer.

3.5.3 Minidoka FMU Objectives and Constraints

- See general Complex goals and objectives in section 3.1.2.
- Due to developing sage grouse concerns and loss of sagebrush habitat wildfires in this FMU will be aggressively suppressed.
- AMR strategy – due to concerns with sagebrush habitat and close proximity to private and other federal lands unplanned fires will be contained at the smallest size possible. The only exception to this AMR strategy would be an unplanned fire on one of the refuge islands where direct attack suppression by fire vehicles is not possible; confine/monitoring may be utilized.

3.5.4 Minidoka FMU Values to Protect

- A large percentage of refuge uplands have been burned in the last 10 years; any remaining sagebrush habitat should be considered a critical protection area.
- Grove of cottonwood and willow tress at Water Unit 1 that supports a great blue heron nest colony.
- Structures located at the refuge headquarters.
- Cultural resource sites, (documented at refuge headquarters).

3.6.1 Oxford Slough FMU Description

Oxford Slough WPA (OSWPA) is located in the upper Cache Valley adjacent to the community of Oxford Idaho. The 1,853-acre WPA is mostly a hardstem bulrush marsh, interspersed with open water and surrounded by areas of playa, saltgrass flats, native wet meadow, and some cropland. The lower areas have visible alkali deposits. The marsh is fed on the north and drained at the south by Deep Creek. A smaller creek and several springs feed the marsh from the west. The water level in the marsh is allowed to fluctuate naturally; in drought years it dries out.

The main marsh area is primarily bulrush emergent, with some cattail. The WPA has expansive drier type grasslands with some wetlands along its east and southwest regions that are more alkali in nature (saltgrass, alkali sacaton, small alkali playas and some taller type grasses), within this area are also scattered patches of greasewood and sagebrush patches. The north end of OSWPA is dominated by hilly agricultural/cropland area. The west side vegetation consists of wet meadow grasslands, some brush, areas of reed canary grass, Juncus spp. and other water tolerant grasses.

The Union Pacific railroad has a track that runs from north-south along the east boundary of the WPA; train activity has caused at least two wildfires in past years. The wet meadow areas along the west side are hayed annually under a cooperative farming agreement. This significantly reduces potential fire behavior in the grassland vegetation next to Oxford.

Table 8: Fuel Model Composition for Oxford Slough WPA

Marsh	FM 3	721 acres	39%
Dry Meadow	FM 1	495 acres	27%
Wet Meadow	FM 1	495 acres	19%
Agricultural	FM 1	143 acres	8%
Shrub	FM 2	87 acres	4%
Open Water/Playa		43 acres	3%

3.6.2 Oxford Slough FMU Fire Environment

The fire behavior potential at Oxford Slough can be influenced by drought years. In dry years water flow into the WPA will stop by mid-summer, curing out the marsh and grassland vegetation. The federally listed Community at Risk of Oxford, Idaho, borders the west side of the WPA. The Complex annually hays approximately 400 acres of grassland adjacent to Oxford which reduces potential fire behavior. No interior roads are present in the WPA which would hamper fire vehicle access to an interior fire. Railroad tracks border the east side of the WPA; two fires have started from trains in past years.

3.6.3 Oxford Slough FMU Objectives and Constraints

- See general Complex goals and objectives in section 3.1.2.
- AMR strategy - due to the close proximity to the community of Oxford, Idaho, any unplanned wildfire will be aggressively suppressed.

3.6.4 Oxford Slough FMU Values to Protect

- The community of Oxford, Idaho.
- A white-faced ibis colony in center of the marsh.

4.0 Wildland Fire Operational Guidance

The procedures used to *implement* the fire management plan (FMP) for the Southeast Idaho National Refuge Complex are covered in this section. Information pertaining to this management is either directly provided or references are cited as to where it may be located.

USF&WS wildland fire management policy states that every wildland fire will be assessed following a decision support process that examines the full range of appropriate management responses (AMR).

This policy also provides that wildland fires may be managed for one or more objectives based on land and resource management plan direction. When two or more wildland fires burn together they will be managed as a single wildland fire and may also be managed for one or more objectives based on land and resource management plan direction as an event moves across the landscape and fuels and weather conditions change.

As stated before, the purpose of fire suppression is to put the fire out in a safe, effective, and efficient manner. Fires are easier and less expensive to suppress when they are contained to small areas on the Complex. Thus, the following procedures will be followed for all wildland fires to ensure optimum resource protection and firefighter safety.

4.1.1 Appropriate Management Response

Evaluation and selection of an appropriate management response to a wildfire will include.

- Consideration of risks to public and firefighter safety.
- Threats to the values to protect.
- Costs of various mitigation strategies and tactics.
- Potential resource benefits.

Wildfires will be staffed or monitored during active burning periods as needed to ensure that appropriate mitigation actions can be made to protect values threatened.

All wildfires will be supervised by a qualified incident commander (IC) responsible to

- Assess the fire situation and make a report to dispatch as soon as possible.

- Use guidance in this FMP or a delegation of Authority to determine and implement an appropriate management response.
- Determine organization, resource needs, strategy and tactics.
- Brief incoming and assigned resources on the organization, strategy and tactics, weather and fire behavior, LCES, and radio frequencies.
- Order resources needed for the AMR through the designated dispatch office.
- Manage the incident until relieved or the incident is under control.

The FMP and a Delegation of Authority can provide a general strategy to an IC, who has discretion to select and implement appropriate tactics within the limits described for the FMU(s), including when and where to use minimum impact suppression tactics (MIST) unless otherwise specified. All resources, including mutual aid resources, will report to the IC (in person or by radio) and receive an assignment prior to tactical deployment.

Critical protection areas, such as refuge headquarters, neighboring residences and ranches, and adjacent private croplands, will receive priority consideration in fire control planning efforts. In all cases, the primary concerns of fire suppression personnel shall be the safety, and if needed, all individuals not involved in the suppression effort may be evacuated.

General AMR Constraints

- Close proximity to private property and residences, (WUI and Communities at Risk).
- Lack of a cultural resource inventory. Limited cultural resource surveys have been completed at the Complex refuges, (completed surveys are on file at the Complex office)
- Soft ground/moist-soil conditions which preclude the use of conventional fire equipment.
- Tracts of continuous vegetation, lack of adequate fire/fuel breaks, and lack of interior and boundary refuge roads.

Interagency Operations

As mentioned in 2.3.2 the Complex coordinates with the BLM, USFS, and BIA in fire management operations. The Complex coordinates with these agencies for dispatch services through EIIFC and SCIDC. Any wildfire AMR actions would be coordinated through the appropriate dispatch centers with neighboring federal agencies.

4.1.2 Preparedness

The Complex is only funded to staff one Type 3 engine crew stationed at Grays Lake NWR. Due to the fact that the Complex refuges are spread across a large portion of eastern Idaho the Complex relies on its interagency partners (BLM and USFS) for initial attack fire response. The Complex fire crew is dispatched through EIIFC which uses a closest forces concept when dispatching fire crews to BLM, USFS, FWS, BIA, and State lands in the fire zone.

The Complex FMO meets with federal cooperators (BLM, USFS, EIIFC, SCIDC) annually prior to fire season, to review the respective agreements. This may include contact information and fire suppression policies and procedures.

The normal fire season for the Complex was discussed in section 3.1.3; prior to and during fire season the following tasks will be implemented and completed.

- The Complex FMO will work with each refuge Manger to update Delegations of Authority for each refuge with suppression constraints.

- Fire qualified personnel work with the Complex FMO to schedule annual medical examinations prior to start of fire season.
- Fire qualified personnel will complete fitness testing, complete the annual refresher, and are issued full personal protective equipment (PPE) prior to the start of fire season.
- A Type 3 engine will be staffed and available annually (June 15th – September 30$^{th)}$ at Grays Lake NWR.
- Prior to fire season the Complex step-up plan will be reviewed by the FMO; the plan will be implemented during fire season according to daily fire weather forecasts.

Annual Refuge Fire Readiness Activities

Activities – Complete before end of month	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Update Interagency Fire Agreements/AOP's		x										
Winterize Fire Management Equipment										x		
Inventory Fire Engine and Cache			x									
Update Delegation of Authority			x									
Completed Annual Fire Physical		x										
Annual Fitness Testing			x									
Annual Refresher Training			x									
Pre-Season Engine Preparation			x									
Prepare Temp Fire Crew hiring packet										x		
Review and Update Fire Management Plan			x									
Hire Temp Fire Crew		x										
Weather Station Maintenance and Calibration			x									
Coordinate with Refuge Managers on HFR planning										x		
Review Delegations of Authority with Refuge Managers			x									
Review Complex step-up plan and adjust if necessary			x									

Communications

The Complex utilizes BLM and USFS communications systems, including repeaters and radio frequencies for fire operations. The Complex has MOUs with both agencies for shared radio frequency use during fire operations. Both EIIFC and SCDIIC centers have a fire zone frequency plan, this plan and radio MOUs are attached in Appendix F. All communications equipment is analog.

4.1.3 Detection

Wildland fires on the Complex Refuges will normally be discovered and reported by local residents and the visiting public. These fires may or may not be reported directly to the refuge manager; it is expected that the reporting individual will contact 911, EIIFC or SCIIDC directly and refuge staff may not learn about the fire until after it has already been staffed. Regardless of how any fires are discovered they need to be reported to the Refuge Manager, FMO, and interagency fire dispatch center (EIIFC and SCIIDC) immediately so suppression actions can be started without delay. In situations where fire danger and staffing levels increase, refuge patrols will be an additional source of detection and reporting.

4.1.4 Dispatch, Initial Response and Initial Attack

Bear Lake, Camas, Grays Lake, and Oxford Slough refuges fall within the East Idaho Interagency Fire Center (EIIFC) dispatch zone. EIIFC will coordinate the initial attack response of federal fire crews to potential fires on these four refuges. The Refuge Manager or a representative from the Complex staff will serve as a Resource Advisor for the incoming Incident Commander (IC).

Minidoka NWR falls within the Southern Idaho Interagency Fire Center (SIIFC) dispatch zone. SIIFC will coordinate initial attack response of federal fire crews to fires at Minidoka.

Upon discovery of a fire, all subsequent actions will be based on the following:

- The Incident Commander (IC) will locate, size-up, and coordinate suppression actions. The IC will start the EIIFC Incident Organizer to document actions, fire behavior and weather conditions.
- Provide for firefighter and public safety.
- Considering the current and predicted fire conditions, the IC will assess the need for additional suppression resources and estimate the final size of the fire. The potential for spread outside of the refuge should be predicted, as well as the total suppression force required to initiate effective containment action at the beginning of each burning period.
- The IC will assess the need for law enforcement personnel for traffic control, investigations, evacuations, etc. and make the request to the dispatch center.
- Document decisions in the Incident Organizer and provide the FMO a copy after the incident is out.
- Should a wildland fire move into an extended attack the IC will coordinate with the Complex staff and EIIFC to complete a Wildland Fire Decision Support System
- The Refuge Manager or designee will provide the IC with a Delegation of Authority.

4.1.5 Extended Attack and Large Fire Management

The Wildland Fire Decision Support System (WFDSS) process will be used when a wildfire escapes initial attack. Due to the limited number of historic large fire occurrences on the Complex, for any potential fire needing a WFDSS the refuge staff would rely on Regional Office fire management staff and interagency partners to prepare the analysis.

Extended attack fires will be managed in accordance with the Interagency Standards for Fire and Aviation Operations (Redbook).

4.1.6 Aviation Operations

All fire-related aviation operations will follow applicable guidelines of the DOI National Business Center - Aviation Management Directorate and must adhere to all DOI aviation policy. Aviation operations at Camas, Grays Lake, Bear Lake, and Oxford Slough refuges will be coordinated through EIIFC. Aviation operations at Minidoka NWR will be coordinated through SCIIDC.

4.1.7 Reviews and Investigations

Reviews and investigations are used by wildland fire and aviation managers to assess and improve the effectiveness and safety of organizational operations. Brief descriptions of various reviews and associated procedures and requirements, including those for serious wildland fire accidents, entrapments, and fire trespass are listed in the Red Book Chapter 18.

Incident Commanders and Single Resource Bosses will ensure After Action Reviews take place in a timely manner and that any significant issues are brought to the attention of the Zone FMO or Refuge Manager.

4.1.8 Reports

The SE Idaho Zone FMO or designee will complete and file an Individual Fire Report (DI-1202) in the FWS Fire Management Information System (FMIS) for the following types of fires within 10 days of a fire being declared out:

- All wildfires on FWS and FWS-protected lands.
- Wildfires threatening our lands on which we take action.
- All escaped prescribed fires. When a fire exceeds prescription, treat must be declared a wildfire, and a separate new report filed to report acres burned by the wildfire from the time of declaration to the time of being declared out.
- All false alarms responded to by SEID fire staff.
- All support actions to interagency cooperators by SEID fire staff.

4.2 Hazardous Fuels Management

All prescribed fire treatments on the Refuges will follow guidance outlined in the Interagency Standards for Fire and Fire Aviation Operations (chapter 17) and the Interagency Fire Planning and Implementation Procedures Reference Guide. See 3.1 for specific prescribed fire objectives.

4.2.1 Prescribed Fire Program for Hazardous Fuels and Habitats

The overall objective in the use of prescribed fire in refuge resource management will be to reduce hazard fuels and to promote habitat diversity. Refuge staff will carefully analyze the needs of hazardous fuels reduction in each FMU in relation to habitat objectives on the refuge. Variables to be considered in each proposed treatment area include previous treatments, vegetation type, endangered species, and hazardous fuels reduction. The prescribed fire program at the Refuge is being conducted under the categorical exclusion directive, 516 DM 2, Appendix 1and 516 DM 6, Appendix 1.

4.2.1.1 Program Overview

Prescribed fire can be a useful tool for restoring and maintaining natural conditions and processes at the Complex refuges. Research burning may also be conducted when determined to be necessary for accomplishment of research project objectives. The goals of prescribed fire are for hazard fuel reduction and to meet resource management objectives. Specific management needs for the refuge will be determined annually. Burn objectives, fire frequency rotation, firing methodology, and prescriptions will vary from year to year. Burn plans will be updated to reflect any variations. The Project Leader will approve prescribed fire plans after review of the plan by the Zone Fire Management Officer.

The desired future of the program includes treating approximately 1000 acres per year in a variety of vegetation types. Prescribed fire activities include mechanical treatments (e.g., thinning), burning, and monitoring.

The prescribed burn window for the Complex is generally early-Spring (March-April) and late-fall (September-November). Specific FMU hazardous fuels objectives and history is described in chapter 3.

Some specific objectives for the refuge program include:

- Conduct a vigorous prescribed fire program with the highest professional and technological standards
- Identify the prescribed burn prescriptions most appropriate to specific situations and areas
- Efficiently accomplish resource management objectives through the application of prescribed fire
- Continually evaluate the prescribed fire program to better meet program goals by refining prescriptions treatments and monitoring methods, and by integrating applicable technical and scientific advancements

4.2.1.2 Effect of National and Regional Preparedness Levels

Prescribed fires may be ignited during National Preparedness Level 4 or 5 as specified in the National Interagency Mobilization Guide. The normal prescribed burn window for the Complex refuges is early spring and late fall; national and regional preparedness levels are low at this time of year.

4.2.1.3 Project Planning

All prescribed fire treatments on the Complex refuges will follow guidance outlined in the Interagency Prescribed Fire Planning and Implementation Procedures Reference Guide.

All prescribed fires will have prescribed burn plans. The prescribed burn plan is a site specific action plan describing the purpose, objectives, prescription, and operational procedures needed to prepare and safely conduct the burn. The treatment area, objectives, constraints, and alternatives will be clearly outlined. The required burn plan elements are outlined in the Interagency Fire Planning and Implementation Procedures Reference Guide and will be included in all refuge burn plans.

The Prescribed Fire Plan Preparer will conduct a field reconnaissance of the proposed burn location with the Complex Biologist, and/or Refuge Manager to discuss objectives, special concerns, and gather all necessary information to write the burn plan.

Every Prescribed Fire Plan must receive a technical review. The Technical Reviewer and Prescribed Fire Plan Preparer must be qualified or have been previously qualified as a Prescribed Fire Burn Boss at an experience level equal to or higher than the complexity being reviewed. The Technical Reviewer must be someone other than the primary preparer of the plan. An off-unit technical review is encouraged to provide an additional independent perspective. It is acceptable for other specialists to review certain portions of the plan however; a primary Technical Reviewer must be designated as technical review signatory. Either the Prescribed Fire Plan Preparer or Technical Reviewer must be currently qualified, less physical fitness requirement.

The Agency Administrator has final approval authority for all Prescribed Fire Plans, unless special circumstances warrant higher review and concurrence (such as may occur during higher Preparedness Levels or for extremely large, complex projects). Although the Agency Administrator has final approval authority for the Prescribed Fire Plan and the Agency Administrator "GO/NO-GO" checklist, the Prescribed Fire Burn Boss has the responsibility to make the on-site tactical "GO/NO-GO" decision. The

Prescribed Fire Burn Boss ensures that all prescription, staffing, equipment, and other plan specifications are met before, during, and after the prescribed fire.

4.2.1.4 Project Implementation

Execution of prescribed burns will only be undertaken by qualified personnel. The Prescribed Burn Boss will fill all required positions to conduct the burn with qualified personnel. All personnel listed in the burn plan must be available for the duration of the burn or the burn will not be initiated.

When all prescription criteria are within the acceptable range, the Prescribed Burn Boss will select an ignition time based on current and predicted weather forecasts. The Burn Boss will ensure that the Agency Administrator GO/NO-GO Checklist is valid and complete and sign the Prescribed Fire GO/NO-GO Checklist the morning of planned ignition.

A thorough briefing will be given by the Prescribed Burn Boss and specific assignments and placement of personnel will be discussed, (using briefing outline in Prescribed Fire Plan). A spot weather forecast will be obtained on the day of ignition and all prescription elements will be rechecked to determine if all elements are still within the approved ranges. If all prescription elements are met, a test fire will be ignited to determine on-site fire behavior conditions as affected by current weather. If conditions are not satisfactory, the test fire will be suppressed and the burn will be rescheduled. If conditions are satisfactory the burn will continue as planned.

A prescribed fire must be declared a wildfire by those identified in the burn plan when that person(s) determines that the contingency actions have failed or are likely to fail and cannot be mitigated by the end of the next burning period. An escaped prescribed fire must be declared a wildfire when the fire has spread outside the project boundary, or is likely to do so, and cannot be contained by the end of the next burning period. A prescribed fire can be converted to a wildfire for reasons other than an escape. An appropriate management response will be made to such incidents and a formal analysis (WFSA) undertaken when needed. The Refuge Manager or Project Leader will be notified of an escaped prescribed fire.

The public will be informed of upcoming planned prescribed fires through press releases in local newspapers. Neighbors to the refuge will be called and local law enforcement agencies will be called and informed of the burn before planned ignition. Notification calls will be documented and saved in the Prescribed Plan file.

4.2.1.5 Smoke Management

According to Fish & Wildlife Service Fire Management Policies " ... fire management activities which result in the discharge of air pollutants are subject to, and must comply with, all applicable Federal, state, interstate, and local air pollution control requirements as specified by Section 118 of the Clean Air Act."

The US Fish and Wildlife Service in south Idaho participates in the Montana/Idaho Airshed Group. The group members include all of the federal agencies, state land management agencies, and private forest products companies. The intent of the Airshed Group is to limit negative impacts from controlled burns through scientific monitoring of weather conditions and formal coordination of burns.

Prior to the burn season the Fire Management Officer submits a list of planned burn projects to the Missoula Monitoring Unit via internet. This information creates a data base describing the type of burn, number of acres in each unit, and unit location and elevation. Each burn unit is assigned an identification number. The day before the planned ignition, the burn boss accesses the internet data base to submit a proposed prescribed burn for the following day. The program coordinator and a meteorologist provide timely restriction messages for airsheds with planned burning.

The Missoula Monitoring Unit issues daily decisions which can restrict burning when atmospheric conditions are not conducive to good smoke dispersion. Restrictions may be directed by airshed, elevation or by special impact zones around populated areas. The burn boss will access the daily decision notice from the monitoring unit via the internet. Prescribed burn projects will not be conducted if the Missoula Monitoring Unit posts a burning restriction for the airshed in which the refuge is located.

No non-attainment areas are located in or near the Complex; specific smoke sensitive areas area identified in individual burn plans and appropriate mitigation measures.

4.2.1.6 After Action and Escaped Fire Reviews

The Burn Boss will ensure an informal After Action Review (AAR) is conducted for each operational period on a prescribed fire, as in Red Book chapter 17.

All prescribed fires declared a wildfire will have an investigative review initiated by the Refuge Manager or Project Leader. The level and scope of the review will be determined by policy and procedures of the Interagency Standards for Fire and Fire Aviation Operations and the FWS Fire Management Handbook.

4.2.1.7 Reports

Burn Plans will specify information to be included in a project file. The Burn Boss will ensure this information is provided to the Refuge Manager and/or Zone Fire Management Officer as specified. This includes documenting conditions and fire behavior during the prescribed fire to assess how well actual fire characteristics fit those predicted, documenting any unanticipated difficulties encountered during implementation, and assessing how well the fire accomplished the intended objectives.

The Burn Boss will complete an Individual Fire Report (DI-1202) with the Zone FMO, who will file an Individual Fire Report (DI-1202) electronically within 10 days of it being declared out.

4.2.2 Non-fire Hazardous Fuels Treatment Program

Non-fire treatment strategies are those that do not involve the use of prescribed fire to meet stated objectives. For the Complex refuges, mechanical and chemical treatment strategies are available as non-fire management tools. The following objectives for non-fire treatments of hazardous fuels on the Complex include:

- Establish defensible space along wildland-urban interface boundary and around Complex improvements and structures.
- Protect habitat from wildfire trespass.
- Restore early successional habitats to promote native species while minimizing invasive species encroachment.
- Maintain fuel loadings within natural ranges of variability for major vegetation types.
- Aid in control of invasive plants and weeds that contribute to the fuel hazard.

Any work requiring heavy equipment, such as mowing, hydro-axe work, fuel break construction, or vegetation removal, should be done with low ground-pressure vehicles to the extent possible when the site is dry enough to prevent damage to soils. Non-fire treatments may be restricted during the nesting season from mid May to early August in areas that provide important habitat for trust wildlife resources.

4.2.3 Process to Identify Hazardous Fuels Treatments

The development of prescribed fire and non-fire hazardous fuel management priorities will be an ongoing process determined annually between the refuge staff and refuge manager based on changing habitat conditions on the refuge, changes in management objectives, and changes in management techniques or new information. The FMO and Complex staff will coordinate with federal and state partners and review existing CWPPs when developing potential hazardous fuels treatments in WUI areas.

4.3 Emergency Stabilization and Rehabilitation

Emergency stabilization (ES) and burned area rehabilitation (BAR) are part of a holistic approach to addressing post wildfire issues which also includes suppression activity damage repair and long-term (>3 years) restoration.

ES is planned actions performed by burned area emergency response (BAER) teams within one year of wildfire containment to stabilize and prevent unacceptable degradation to natural and cultural resources, to minimize threats to life or property resulting from the effects of a fire, or to repair/replace/construct physical improvements necessary to prevent degradation of land or resources.

BAR is efforts undertaken within three years of wildfire containment to repair or improve fire-damaged lands unlikely to recover naturally to management approved conditions, or to repair or replace minor facilities damaged by fire. The process concludes with long-term restoration.

The incident management team, local fire resources, or refuge staff begins the process by repairing suppression activity damage. These actions are charged to the fire suppression accounting code. Fire suppression activity damage rehabilitation involves short-term actions to repair and rehabilitate damage to lands, resources, and facilities caused by the wildland fire suppression effort or activities. This includes dozer lines, camps, and staging areas; damaged facilities (fences, buildings, bridges, etc.); handlines; roads; etc. The project leader should ensure this work is complete before incident demobilization, or as soon thereafter as possible or practicable. Damage caused by backfires and burnouts to stop fire spread falls under fire damage restoration and does not qualify as damage caused by suppression action.

The Refuge Manager will coordinate with the Incident Commander, Zone FMO, and Regional Office fire staff to determine if an ES or BAR plan is needed for a Wildland fire incident. The Refuge Manager will form an interdisciplinary team which could include fire and resource specialists to develop and write the ERS Plan. The ES or BAR plans must include provisions for monitoring and evaluation of treatments and techniques, and a procedure for collecting, archiving, and disseminating results. For multi-agency fires, we will do joint planning and implementation. Plans must ensure that the treatments proposed are environmentally, culturally, and socially acceptable, meet the objectives of Comprehensive Conservation and Habitat Management Plans, and comply with legal requirements. Each ES or BAR Plan will include a cost/risk analysis of proposed emergency rehabilitation treatment actions to assist agency administrators and reviewing authorities in assessing the proposed actions. The level and sophistication of the analysis should be commensurate with the scope and complexity of the plan.

ES plans should be submitted to the Regional Fire Management Coordinator (RFMC) within 7 calendar days of the wildfire containment. If additional time is needed, extensions may be negotiated with the (RFMC). BAR plans must be submitted before the end of the fiscal year in which the wildfire fire occurs.

Additional ES and BAR guidance may be found in the FWS Directives (095 FW3) and the Interagency Burned Area Emergency Response Guidebook.

4.4 Prevention, Mitigation and Education

The fire education program for the refuges making up the Southeast Idaho National Wildlife Refuge Complex will include fire prevention, mitigation, and information specific to the ecological aspects of fire and its interaction with refuge habitats. The program will be aimed at increasing public understanding of the complexities of the overall fire program and will seek to influence attitudes and behavior of adults and children. Attention will be given to social groups, elected officials, schools, and all other interested parties of any age.

Fire education messages will include how and why fire burns the way it does and the effects – both negative and positive – that fire has on plant, wildlife, and human populations. Focus will be given to the effect fuel, weather, and topography have on fire behavior clearly demonstrating the effect manipulation of fuels can have on the opportunity for a fire to burn through a given area.

All education efforts will be consistent with approved Service national and regional messaging. These efforts will be interagency when appropriate.

The fire prevention goal for the entire complex will be to prevent unwanted human-caused fires. High visitor use due to close proximity to large population areas increases the likelihood of careless human ignitions. Although campfires are not allowed on the refuges except in campgrounds, abandoned campfires are one of the concerns to be addressed in fire prevention efforts. Debris burning on neighboring private land, smoking, and fires ignited from vehicles also share some concern and will be addressed in conjunction with other agencies to protect human life and property, natural resources, and prevent damage to cultural resources or physical facilities.

During the typical fire season prevention efforts will be elevated commensurate with fire danger. Refuge employees must be kept informed about changes in the fire situation. Visitor contacts, signing, handouts and interpretive programs may be utilized to increase visitor and neighbor awareness of fire hazards. Due to lack of staffing on each individual refuge, collaboration with interagency partners such as local fire departments, the Bureau of Land Management, the Forest Service, and the Idaho Department of Lands is critical for maintaining a fire prevention presence with the public. The complex will support interagency fire prevention efforts through use of severity funding, increased personnel presence, large scale campaigns, etc.

During periods of extreme or prolonged fire danger emergency restrictions regarding refuge operations or area closures may become necessary. Such restrictions will usually be consistent with those implemented by cooperators. The FMO will recommend when such restrictions may be necessary. Closures will be authorized by the Project Leader in consultation with Refuge Managers and the FMO.

All of the refuges are bordered by private property and have areas identified as at risk to wildfire should one start on the refuge. These areas will be addressed in County Wildfire Protection Plans and treated by chemical, mechanical or prescribed fire means as appropriate to reduce the risk. Refuge personnel will work with interagency partners to educate the community on fire mitigation techniques, consequences of doing or not doing the prescribed treatment, and issues related to any resulting smoke. A message of personal responsibility and Firewise principles will be included in any public contacts regarding fire mitigation.

Fire Investigation
Fire management personnel will attempt to locate and protect the probable point of origin and record pertinent information required to determine fire cause. They will be alert for possible evidence, protect the scene and report findings to the fireline supervisor.

Prompt and efficient investigation of all suspicious fires will be carried out. However, fire management personnel should not question suspects or pursue the fire investigation unless they are currently law enforcement commission qualified.

Personnel and services of other agencies may be utilized to investigate wildland fire arson or fire incidents involving structures. All fire investigations should follow the guidelines outlined in 4.1-2 of the Fire Management Handbook (2000).

For fires of suspicious origin the IC or refuge Manager may request a Fire Investigator through the appropriate dispatch center (EIIFC or SCIIDC).

Public Information and Education
People who live in this area are used to prescribed burning by the private ranch owners. The burning of ditches and farm fields is a common practice in Southeast Idaho.

The public will be notified of planned prescribed burning in advance of any actions via news releases and direct phone contact to neighboring residences. The role of wildland fire and prescribed fire may be incorporated into presentations that are given to various user groups and visiting public.

Educating the public on the value of fire as a natural process is important to increasing public understanding and support for the fire management program. The refuge will use the most appropriate and effective means to explain the overall fire and smoke management program. This may include supplemental handouts, signs, personal contacts, auto tour routes, or media releases. When necessary, interpretive presentations will address the fire management program and explain the role of fire in the environment.

5.0 Monitoring and Evaluation

Monitoring and evaluation are essential elements of the Complex's fire management program. They provide the means by which refuge personnel are able to determine if applicable sections of the fire management plan are being implemented as planned and if fire-related goals and objectives are being achieved.

5.1 Fire Management Plan

5.1.1 Annual FMP Review
This FMP will be reviewed annually and updated as needed, upon local agency administrator approval. Revisions of FMPs with Regional review and concurrence are required every five years and following completion of a new (or significantly revised) CCP or habitat management plan.

5.1.2 Fire Management Plan Terminology

Terms in the FMP are defined in the National Wildfire Coordinating Group glossary, located at http://www.nwcg.gov/pms/pubs/glossary. Any terms used not in the glossary are defined below.

5.2 Treatment Effectiveness

Basic monitoring to determine habitat response will generally use photo-points, which will be re-visited and photographed during subsequent seasons. Comparisons over time will aid in determining if burn objectives and resource objectives are being met. More complex monitoring efforts may be undertaken for research-related prescribed burns, or to answer questions about the effects of prescribed fire on specific wildlife or other habitat parameters. Such monitoring can require vegetation transects, breeding bird point counts, presence/absence of target species, etc. An excellent reference resource for monitoring procedures can be found within the Fire Monitoring Handbook, USDI, and National Park Service, 2007.

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Appendix H. Cultural Resource Management Plan

The Comprehensive Conservation Plan represents an opportunity to improve management for the Camas National Wildlife Refuge. Cultural resource management should be an integral part of habitat and people management, not just because the law mandates it but for the unique information it can bring to understanding our environment. The following issues are very important:

1. How do we maintain the integrity of the Refuge's cultural resources while managing and restoring wildlife habitat?
2. How do we work and consult with federally recognized tribes on the management of Native American cultural resources in a manner that facilitates the mission of the Refuge and addresses issues of importance to Tribes?
3. How do we work and consult with federally recognized tribes on the disposition of human remains, funerary objects, sacred objects and objects of cultural patrimony as defined under the Native American Graves Protection and Repatriation Act?
4. How do we incorporate cultural resources into an interpretive and recreation program that illustrates humankind's interaction with the natural world?

These issues illustrate some of the Service's legally mandated responsibilities for cultural resources management. The management of cultural resources is an integral element of the process of meeting the Refuge's obligations, and consequently, of fulfilling its stated purpose. To this end, we recommend that the CCP includes the following goal:

Goal: Protect, preserve, evaluate, and interpret the cultural heritage and resources of the Refuge while consulting with appropriate Native American groups and preservation organizations, and complying with historic preservation legislation.

With this goal in mind, we would implement the following objectives and strategies:

Objective CR1: Implement a proactive cultural resources management program that focuses on meeting the requirements of the National Historic Preservation Act, including consultation, identification, inventory, evaluation, and protection of cultural resources.

Achievement Strategies

A. Identify cultural resources (archaeological sites, buildings, and structures) that coincide with existing and planned roads, facilities, public use areas, and habitat projects. Evaluate threatened and impacted sites and structures for eligibility to the National Register of Historic Places. Prepare and implement activities to avoid and/or mitigate impacts to sites and structures as necessary.
B. Prepare a Historic Structures Report and Determination of Eligibility for the Brindley Barn.
C. Implement a proactive historic preservation program to evaluate eligibility to the National Register of Historic Places of those archaeological sites and historic-era buildings and structures that may be impacted by Service undertakings, management activities, erosion, or neglect. Conduct formal consultation with SHPO regarding the Determinations of Eligibility (DOE) for the backlog of previously recorded sites and for any newly discovered resources.

D. Develop a GIS layer for cultural resources that can be used with other GIS layers for the Refuge, yet contains appropriate locks to protect sensitive information. Include a layer that contains all of the historic-period land patents, with the individuals' names and date of patent.
E. Develop partnerships with the Tribes for cultural resources inventory, evaluation, and project monitoring, consistent with the regulations of the National Historic Preservation Act.
F. Submit proposals to the Refuge Operations Needs System (RONS) to develop: 1) a cultural resource management plan as defined above; 2) to obtain all of the Homestead Act land patent records for homesteads patented with the refuge boundaries; 3) complete the DOEs for the previously recorded sites; 4) complete a Historic Structures Report and DOE for the Brindley Barn; 5) submit a plan or Challenge Cost-share grant request to preserve the barn; 6) a quarter of a full-time equivalent position for cultural resource interpretation and education with a minimum of $5,000 allocated yearly for supplies and materials.

Rationale: Various Federal historic preservation laws and regulations require the Service to implement the kind of program described under this objective. Inattention to these responsibilities may obstruct the Refuge in its other land, habitat, and wildlife management efforts.

Objective CR2: Develop, in partnership with the Tribes and other preservation partners, a program for the education and interpretation of cultural resources of the Refuge.

Achievement Strategies

A. Prepare interpretive media (e.g., pamphlets, signs, exhibits) that relate to cultural resources.
B. Prepare environmental/cultural education materials for use in local schools and museums concerning cultural resources, the discipline of archaeology, the perspective of Native Americans, the history of the area, and conservation of natural and cultural resources. These materials could include an artifact replica kit with hands-on activities and curriculum prepared in consultation with the local school district, historical societies, and the Tribes.
C. Consult with the Tribes, historical societies, and other preservation partners to identify the type of cultural resources information appropriate for public interpretation.
D. Develop an outreach program and materials so that the cultural resource messages become part of cultural events in the area, including National Wildlife Refuge Week and appropriate local festivals.
E. Develop Museum Property Inventory. Create storage and use plans for museum property as part of the outreach program.
F. Submit proposals to the Refuge Operations Needs System (RONS) to develop a quarter of a full-time equivalent position for cultural resource interpretation and education with a minimum of $5,000 allocated yearly for supplies and materials.

Rationale: Cultural resources are not renewable. Thus, interpretation of cultural resources can instill a conservation ethic among the public and others who encounter or manage them. The goals of the cultural resource education and interpretive program are fourfold: (1) translate the results of cultural research into media that can be understood and appreciated by a variety of people, (2) relate the connection between cultural resources and natural resources and the role of humans in the environment, (3) foster an awareness and appreciation of native cultures, and (4) instill an ethic for the conservation of our cultural heritage.

Objective CR3: Create and use a Memorandum of Understanding with Native American groups to implement the inadvertent discovery clause of the Native American Graves Protection and Repatriation Act (NAGPRA).

Achievement Strategies

A. Identify Native American Tribes, Groups, and direct lineal descendants that may be affiliated with the refuge lands.
B. Open consultation process with affiliated Tribes, Groups, and direct lineal descendants.
C. Define funerary objects, sacred objects and objects of cultural patrimony.
D. Develop procedures to follow for intentional and inadvertent discoveries.
E. Identify persons to contact for the purposes of NAGPRA.
F. Submit a quarter of a full-time equivalent position for cultural resource interpretation and education be submitted to the Refuge Operations Needs System. A minimum of five thousand dollars should be allocated yearly for supplies and materials.
G. Submit to RONS a 1/8 full-time equivalent (FTE) position for two years to negotiate and complete an MOU, with $25,000 for travel expenses.

Rationale: Development of a Memorandum of Understanding prior to an inadvertent discovery is strongly suggested by the NAGPRA implementing regulations. Such an agreement can greatly facilitate and speed up consultations as required by law after an inadvertent discovery.

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Appendix I. Glossary

I.1 Abbreviations

Act	National Wildlife Refuge System Improvement Act of 1997 (also Improvement Act or NWRSIA)
ABA	Architectural Barriers Act
ABC	American Bird Conservancy
ac.	Acres
ac/ft	Acre-Feet
ABA	Architectural Barriers Act
ADC	Animal Damage Control
AHPA	Archaeological and Historic Preservation Act
AM	Adaptive Management
ARPA	Archaeological Resources Protection Act
ATR	Auto Tour Route
ATV	All-Terrain Vehicles
AWP	Annual Work Plan
AUD	Appropriate Use Determination
AUM	Animal Use Month
BCC	Birds of Conservation Concern
BCR	Bird Conservation Region
BIDEH	Biological Diversity, Integrity, and Environmental Health
BLM	U.S. Bureau of Land Management
BP	Before Present
BYU-Idaho	Brigham Young University, Idaho
°C	Degrees Celsius
CAA	Clean Air Act
CCP	Comprehensive Conservation Plan
CD	Compatibility Determination
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CLMA	Cooperative Land Management Agreement
CO_2	Carbon Dioxide
cm	Centimeter
CWCS	Comprehensive Wildlife Conservation Strategy (State)
CWMA	Continental Divide Weed Management Area
CY	Calendar Year
dbh	Diameter of a tree at breast height
DO	Dissolved oxygen, a measure of water quality
DEQ	Department of Environmental Quality
DM	Departmental Manual (USFWS)
EA	Environmental Assessment
EE	Environmental Education
EIA	Ecological Integrity Assessment
EIS	Environmental Impact Assessment
ENSO	El Niño/La Nina Southern Oscillation
EPA	U.S. Environmental Protection Agency

ESA	Endangered Species Act
ESRP	Eastern Snake River Plain
°F	Degrees Fahrenheit
FMP	Fire Management Plan
FWS	U.S. Fish and Wildlife Service (also, Service, USFWS)
FY	Fiscal Year
GCM	Global Climate Model
GIS	Geographic Information System
GMU	Game Management Unit (IDFG)
GPS	Global positioning system
HACCP	Hazard Analysis and Critical Control Point
HGM	Hydrogeomorphic
IAC	Interagency Committee for Outdoor Recreation
IBA	Important Bird Area
IBCP	Idaho Bird Conservation Plan
IBIS	Idaho Bird Inventory and Survey Program
ICWCS	Idaho Comprehensive Wildlife Conservation Strategy
IDDEQ	State of Idaho Department of Environmental Quality
IDFG	State of Idaho Department of Fish and Game
IDPR	Idaho Department of Parks and Recreation
IDWR	State of Idaho Department of Water Resources
Improvement Act	National Wildlife Refuge System Improvement Act of 1997 (also Act, NWRSIA)
I&M	Inventory and Monitor
INL	Idaho National Laboratory
IPCC	Intergovernmental Panel on Climate Change
IPM	Integrated Pest Management
ISU	Idaho State University
IWJV	Intermountain West Joint Venture
IWWCP	Intermountain West Waterbird Conservation Plan
kg	Kilogram
IDT	State of Idaho Transportation Department
LCC	Landscape Conservation Cooperative
LE	Law Enforcement
LPP	Land Protection Plan
LWG	Local Working Group (sage-grouse)
m	Meter
MAPS	Monitoring Avian Productivity and Survivorship
MBCC	Migratory Bird Conservation Commission
MBMO	Migratory Bird Management Office
MMS	Maintenance Management System
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NAGPRA	Native American Graves Repatriation Act
NAS	National Audubon Society
NAWMP	North American Waterfowl Management Plan
NCDC	National Climate Data Center
NEPA	National Environmental Policy Act
NGO	Nongovernmental Organization

NHPA	National Historic Preservation Act
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NSRE	National Survey on Recreation and the Environment
NVCS	National Vegetation Classification Standard
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
NWRS	National Wildlife Refuge System
NWRSIA	National Wildlife Refuge System Improvement Act of 1997
NRCS	National Resource Conservation Service
OC	Organochlorine Compounds
ORV	Off-road vehicle
PDO	Pacific Decadal Oscillation
NWS	National Weather Service
PIF	Partners in Flight
PFC	Pacific Flyway Council
pH	Potential Hydrogen
PMU	Population Management Unit (IDFG)
PPM	Parts Per Million
PPP	Preliminary Project Proposal
PRISM	Parameter-elevation Regressions on Independent Slopes Model
R1	Region 1 of the FWS (WA, OR, ID, HI and Pacific islands)
RMP	Rocky Mountain Population (sandhill crane, Canada goose, trumpeter swan)
ROC	Resource of Concern
RONS	Refuge Operating Needs System
ROCO	Rocky Mountains and Columbia Basin
RV	Recreational Vehicle
SCA	Soil Conservation Service
SCBD	Secretariat for the Convention on Biodiversity
SCEP	Student Educational Employment Program
SCORPT	Statewide Comprehensive Outdoor Recreation and Transportation Plan
Service	U.S. Fish and Wildlife Service (also FWS, USFWS)
SGCN	Species of Greatest Conservation Need
SHPO	State Historic Preservation Officer
SMU	Smoke Management Unit
SST	Sea Surface Temperatures
STEP	Student Temporary Employment Program
SUP	Special Use Permit
TDS	Total Dissolved Solids
TMDL	Total maximum daily load
TNC	The Nature Conservancy
TP	Total Phosphorous
TPY	Tons Per Year
TSS	Total Suspended Solids
USDA	U.S Department of Agriculture
USDI	U.S. Department of Interior
USFS	U.S. Forest Service
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service

USU	Utah State University
WPA	Work Progress Administration
UTV	Utility Terrain Vehicle
WRCC	Western Regional Climate Center
WMA	Wildlife Management Area (State of Idaho)
WRRP	Wetland and Riparian Rehabilitation Plan
X-C Skiing	Cross Country Skiing
YACC	Young Adult Conservation Corps
YCC	Youth Conservation Corps

I.2 Glossary

303(d) listed water bodies. Section 303(d) of the Clean Water Act requires states, territories, and authorized tribes to develop lists of impaired waters. These are waters that are too polluted or otherwise degraded to meet the water quality standards set by states, territories, or authorized tribes. The law requires that these jurisdictions establish priority rankings for waters on the lists and develop TMDLs for these waters (USEPA).

Adjudication. The judicial process through which the existence of a water right is confirmed by court decree.

Aquifer. A body of saturated rock through which water can easily move.

Alluvium. Sediment transported and deposited in a delta or riverbed by flowing water.

Adaptive Management. The rigorous application of management, research, and monitoring to gain information and experience necessary to assess and modify management activities. A process that uses feedback from refuge research and monitoring and evaluation of management actions to support or modify objectives and strategies at all planning levels. (Service Manual 602 FW 1.4)

Alternative. Different sets of objectives and strategies or means of achieving refuge purposes and goals, helping fulfill the Refuge System mission, and resolving issues. (Service Manual 602 FW 1.6). The “no action” alternative is current refuge management, while the “action” alternatives are all other alternatives.

Appropriate Use. A proposed or existing use on a refuge that meets at least one of the following four conditions:
(1) The use is a wildlife-dependent recreational use as identified in the Improvement Act.
(2) The use contributes to fulfilling the refuge purpose(s), the Refuge System mission, or goals or objectives described in a refuge management plan approved after October 9, 1997, the date the Improvement Act was signed into law.
(3) The use involves the take of fish and wildlife under State regulations.
(4) The use has been found to be appropriate as specified in section 1.11 of the USFWS Appropriate Use Policy (603 FW 1).

Approved Refuge Boundary. A National Wildlife Refuge boundary approved by the National or Regional Fish and Wildlife Service Director. Within this boundary, the Service may negotiate with landowners to acquire lands not already owned by the Service. (modified from Region 1 Landowner Guide, USFWS Division of Refuge Planning)

Archaeology. The scientific study of material evidence remaining from past human life and culture. (Webster’s II)

Association or Plant Association: The finest level of biological community organization in the US National Vegetation Classification (NVCS), defined as a plant community with a definite floristic composition, uniform habitat conditions, and uniform physiognomy.
With the exception of a few associations that are restricted to specific and unusual environmental conditions, associations generally repeat across the landscape. They also

occur at variable spatial scales depending on the steepness of environmental gradients and the patterns of disturbances. (The Nature Conservancy 2003)

B.P. (Before Present). Used as a designation following radiocarbon dates to express the point from which radiocarbon years are measured. This measuring point is arbitrarily taken to be 1950. A date of 5,200±200 B.P. means that it dates to 5,200 (plus or minus 200) years before 1950.

Benefiting Resources. Those species, species groups, or resources expected to benefit from actions taken for a Resource of Concern.

Biological Diversity: The variety of living organisms considered at all levels of organization including the genetic, species, and higher taxonomic levels. Biological diversity also includes the variety of habitats, ecosystems, and natural processes occurring therein. (The Nature Conservancy 2003)

Birds of Conservation Concern. A category assembled by the U.S. Fish and Wildlife Service Division of Migratory Birds identifying the migratory and non-migratory species (beyond those already designated as Federally threatened or endangered) that represent the Division's highest conservation priorities. (FWS, Division of Migratory Birds)

Biological Diversity (also Biodiversity). 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 (FWS Manual 601 FW 3). The System's focus is on indigenous species, biotic communities, and ecological processes.

Biological Integrity. Biotic composition, structure, and functioning at genetic, organism, and community levels comparable with historic conditions, including the natural biological processes that shape genomes, organisms, and communities. (FWS Manual 601 FW 3)

Call (water rights). A "call" is a request by an appropriator for water which the person is entitled to under his decree. Such a call will force those users with junior decrees to cease or diminish their diversions and pass the requested amount of water to the downstream senior making the call. (Glossary of Water Terminology, Colorado State University)

Candidate Species. Plant or animal species for which FWS or NOAA Fisheries has on file sufficient information on biological vulnerability and threats to support a proposal to list as endangered or threatened. (FWS, Endangered Species Glossary, http://www.fws.gov/endangered/glossary.html)

Categorical Exclusion. A category of actions that do not individually or cumulatively have a significant effect on the human environment and have been found to have no such effect in procedures adopted by a Federal agency pursuant to the National Environmental Policy Act (40 CFR 1508.4).

Code of Federal Regulations (CFR). A codification of the regulations published in the Federal Register by the executive departments and agencies of the Federal government. The CFR is divided into 50 titles that represent broad areas subject to Federal regulation. Title 50 contains wildlife and fisheries regulations.

Compatible Use. A wildlife-dependent recreational use or any other use of a refuge that, in the sound professional judgment of the Director, will not materially interfere with or detract from the fulfillment of the Mission of the System or the purposes of the Refuge (Service Manual 603 FW 3.6). A compatibility determination supports the selection of compatible uses and identifies stipulations or limits necessary to ensure compatibility.

Composition (plant). The inventory of plant species found in any particular area.

Comprehensive Conservation Plan. 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 purpose(s) of the Refuge; helps fulfill the mission of the System; maintains and, where appropriate, restores the biological integrity, diversity, and environmental health of each refuge and the System; helps achieve the goals of the National Wilderness Preservation System, if appropriate; and meets other mandates. (FWS Habitat Management Planning policy, 602 FW 1.4)

Connectivity. The arrangement of habitats that allows organisms and ecological processes to move across the landscape; patches of similar habitats are either close together or linked by corridors of appropriate vegetation. The opposite of **fragmentation.**

Conservation Target or Target (also see **Resources of Concern; Priority Species, Species Groups,** and **Communities).** Term used by land management agencies and conservation organizations to describe the resources (ecological systems, ecological communities, species, species groups, or other natural resources) selected as the focus of conservation planning or actions. (adapted from Low, Functional Landscapes, 2003)

Consumptive use. Recreational activities, such as hunting and fishing that involve harvest or removal of wildlife or fish, generally to be used as food by humans.

Contaminants or **Environmental contaminants.** Chemicals present at levels greater than those naturally occurring in the environment resulting from anthropogenic or natural processes that potentially result in changes to biota at any ecological level. (USGS, assessing EC threats to lands managed by USFWS) Pollutants that degrade other resources upon contact or mixing. (Adapted from Webster's II)

Cooperative Agreement. An official agreement between two parties.

Cover. The estimated percent of an area, projected onto a horizontal surface, occupied by a particular plant species.

Critical Habitat. Those areas that support rare, threatened or endangered species, or serve as sensitive spawning and rearing areas for aquatic life as designated by the U.S. Fish and Wildlife Service or NOAA Fisheries pursuant to the Endangered Species Act (16 USC 1531).

Cultural Resources. The physical remains, objects, historic records, and traditional lifeways that connect us to our nation's past. (USFWS, Considering Cultural Resources)

Cultural Resource Inventory. A professionally conducted study designed to locate and evaluate evidence of cultural resources present within a defined geographic area. Inventories may involve various levels, including background literature search, comprehensive field examination to identify all exposed physical manifestations of cultural resources, or sample inventory to project site distribution and density over a larger area. Evaluation of identified cultural resources to determine eligibility for the National Register follows the criteria found in 36 CFR 60.4. (Service Manual 614 FW 1.7)

Decadence. Marked by decay or decline. For plants, showing little or no new growth. (Adapted from Merriam-Webster online dictionary)

Decree. An official document issued by the court defining the priority, amount, use, and location of a water right.

Disturbance. Significant alteration of habitat structure or composition, or of the behavior or wildlife. May be natural (e.g., fire) or human-caused events (e.g., aircraft overflight).

Drawdown. A lowering of the ground-water surface caused by pumping.

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.

Environmental Assessment. A concise public document, prepared in compliance with the National Environmental Policy Act, that briefly discusses the purpose and need for an action, alternatives to such action, and provides sufficient evidence and analysis of impacts to determine whether to prepare an environmental impact statement or finding of no significant impact (40 CFR 1508.9).

Endangered Species (Federal). An animal or plant species in danger of extinction throughout all or a significant portion of its range. (FWS, Endangered Species Glossary)

Environmental Health. Composition, structure, and functioning of soil, water, air, and other abiotic features comparable with historic conditions, including the natural abiotic processes that shape the environment. (FWS Manual 601 FW 3)

Enhance. To improve the condition of an area or habitat, usually for the benefit of certain native species.

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).

Floodplain. Mostly level land along rivers and streams that may be submerged by floodwater. A 100-year floodplain is an area which can be expected to flood once in every 100 years.

Fluvial processes. Referring to the physical interaction of flowing water and the natural channels of rivers and streams.

Global Positioning System (GPS). A location determination network that uses satellites to act as reference points for the calculation of position information. These man-made reference points can be viewed as aerial lighthouses that are visible to user equipment and can also transmit additional information that can provide extremely accurate location information to the GPS function within location determination devices. (The Wireless Dictionary)

Goal. Descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units. (Service Manual 620 FW 1.6)

Habitat. The place or type of site where species and species assemblages are typically found and/or are successfully reproducing. They are named according to the features that provide the underlying structural basis for the community. (The Nature Conservancy 2003)

Habitat Management Plan. A plan that provides refuge managers a decision-making process; guidance for the management of refuge habitat; and long-term vision, continuity, and consistency for habitat management on refuge lands. (FWS Habitat Management Planning policy 620 FW 1.4)

Habitat Restoration. Management emphasis designed to move ecosystems to desired conditions and processes, and/or to healthy ecosystems.

Hemi-Marsh. Classified as the deeper portion of palustrine emergent wetlands. The habitat types within the "hemi-marsh" system include: permanently flooded open water; submergent aquatic vegetation habitats; and semi-permanently flooded deep emergent bulrush habitat. The Hemi-Marsh stage occurs when an equal 50:50 mix of deep emergent bulrush and open water/submergent habitat are present, and is considered critical to fulfilling the life history strategies of numerous wetland dependent wildlife species (Weller and Spatcher 1965).

Historic Conditions. Composition, structure, and functioning of ecosystems resulting from natural processes that we believe, based on sound professional judgment, were present prior to substantial human related changes to the landscape. (FWS Manual 601 FW 3). Also see Presettlement Conditions.

Hydrograph. The annual flow pattern of a river.

Hydrologic Regime. The normal pattern of precipitation (snow and/or rainfall) and runoff occurring in an area.

Indicator. A measurable characteristic of a key ecological attribute that strongly correlates with the status of the key ecological attribute.

Indicator Species. A species used as a gauge for the condition of a particular habitat, community, or ecosystem. A characteristic or surrogate species for a community or ecosystem (The Nature Conservancy 2003).

Inholding. Refers to lands within an Approved Refuge Boundary that are not owned by the U.S. Fish and Wildlife Service. These can be private lands or lands owned by city, county, State, or other Federal agencies.

Integrated Pest Management (IPM). The use of pest and environmental information in conjunction with available pest control technologies to prevent unacceptable levels of pest damage by the most economical means and with the least possible hazard to persons, property, and the environment. (U.S. EPA Pesticide Glossary)

Interpretation. A teaching technique that combines factual information with stimulating explanation (yourdictionary.com). Frequently used to help people understand natural and cultural resources.

Introduced species. With respect to a particular ecosystem, any species, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem. Introduced species often compete with and cause problems for native species. Introduced species are also called exotic, nonnative, and alien species. (see *Invasive Species*)

Invasive Species. An introduced species that out-competes native species for space and resources.

Inventory. A survey of the plants or animals inhabiting an area.

Issue. 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. (Service Manual 620 FW 1.6)

Key Ecological Attribute. Those aspects of the environment, such as ecological processes or patterns of biological structure and composition that are critical to sustain the long-term viability of the target. These key ecological attributes are further divided into measurable indicators.

Keystone Species. A species whose impacts on its community or ecosystem are large; much larger than would be expected from its abundance (for example, cottonwoods, beavers, gray wolves). Their removal initiates changes in ecosystem structure and often loss of diversity. (Adapted from The Nature Conservancy 2003)

Lacustrine Wetlands. Those areas that are generally permanently flooded and lacking trees, shrubs, or emergent vegetation with greater than 30 percent areal coverage and measuring greater than 20 acres. Smaller areas than this can be included if the water depth in the deepest part of the basin exceeds 6.6 feet at low water. (National Wetlands Inventory)

Landform. A natural feature of a land surface. (yourdictionary.com)

Maintenance. The upkeep of constructed facilities, structure, and capitalized equipment necessary to realize the originally anticipated useful life of a fixed asset. Maintenance includes preventative maintenance; cyclic maintenance; repairs; replacement of parts, components, or items of equipment, periodic condition assessment; periodic inspections, adjustment, lubrication and cleaning (non-janitorial) of equipment; painting, resurfacing, rehabilitation; special safety inspections; and other actions to ensure continuing service and to prevent breakdown.

Maintenance Management System (MMS). A national database of refuge maintenance needs and deficiencies. It serves as a management tool for prioritizing, planning, and budgeting purposes. (RMIS descriptions)

Mesic. Habitats characterized by or requiring a moderate amount of moisture, as compared to hydric (wet) or xeric (dry) habitats. (Adapted from Merriam-Webster online)

Migration. The seasonal movement from one area to another and back.

Migratory birds. Those species of birds listed under 50 CFR section 10.13. (FWS Manual 720FW 1, Policies and Responsibilities of the Migratory Bird Program)

Monitoring. The process of collecting information to track changes of selected parameters over time.

National Environmental Policy Act of 1969 (NEPA). Requires all Federal 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)

Native. With respect to a particular ecosystem, a species that, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem. (FWS Manual 601 FW 3)

National Register of Historic Places. The Nation's master inventory of known historic properties administered by the National Park Service. Includes buildings, structures, sites, objects, and districts that possess historic, architectural, engineering, archeological, or cultural significance at the national, state, and local levels. (USFWS, Considering Cultural Resources)

National Vegetation Classification Standard (NVCS). A hierarchical list of vegetation types and their descriptions intended to produce uniform statistics about vegetation resources across the United States, based on data gathered at local, regional, or national levels. (Adapted from Federal Geographic Data Committee)

National Wildlife Refuge. A designated area of land, water, or an interest in land or water within the Refuge System, excluding coordination areas. (FWS Manual 601 FW 1.3)

National Wildlife Refuge System. Various categories of areas administered by the Secretary of the Interior for the conservation of fish and wildlife, including species threatened with extinction; all lands, waters, and interests therein administered by the Secretary as wildlife refuges; areas for the protection and conservation of fish and wildlife that are threatened with extinction; wildlife ranges; game ranges; wildlife management areas; or waterfowl production areas.

National Wildlife Refuge System Improvement Act of 1997 (Public Law 105-57). A Federal law that amended and updated the National Wildlife Refuge System Administration Act of 1966 (16 U.S.C. 668).

Nephelometric turbidity unit (NTU). Unit of measure for the turbidity of water. Essentially, a measure of the cloudiness of water as measured by a nephelometer. Turbidity is based on the amount of light that is reflected off particles in the water. (USGS Water Science Glossary of Terms)

Nonconsumptive Recreation. Recreational activities that do not involve harvest, removal, or consumption of fish, wildlife, or other natural resources.

Noxious Weed. A plant species designated by Federal or State law as generally possessing one or more of the following characteristics: aggressive or difficult to manage; parasitic; a carrier or host of serious insect or disease; or non-native, new, or not common to the United States. According to the Federal Noxious Weed Act (PL 93-639), a noxious weed is one that causes disease or had adverse effects on man or his environment and therefore is detrimental to the agriculture and commerce of the United States and to the public health.

Objective. A concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it, and who is responsible for the work. Objectives derive from goals and provide the basis for determining strategies, monitoring refuge accomplishments, and evaluating the success of strategies. Objectives should be attainable, time-specific, and measurable. (Service Manual 620 FW 1.6)

Operations. Activities related to the normal performance of the functions for which a facility or item of equipment is intended to be used. Costs such as utilities (electricity, water, sewage) fuel, janitorial services, window cleaning, rodent and pest control, upkeep of grounds, vehicle rentals, waste management, and personnel costs for operating staff are generally included within the scope of operations.

Pacific Flyway. One of several major north-south travel corridors for migratory birds in North America. The Pacific Flyway is west of the Rocky Mountains. Other flyways include the Central, Mississippi, and Atlantic.

Palustrine Wetlands. Wetlands that may or may not be permanently flooded and typically recognized by the presence of trees, shrubs, or herbaceous emergent vegetation. May include non-vegetated areas measuring less than 20 acres in extent and with water depths shallower than 6.6 feet in the deepest part of the basin at low water (Cowardin et al. 1979).

Planning Team. The primary U.S. Fish and Wildlife staff and others who played a key role in developing and writing the CCP. Planning teams are interdisciplinary in membership and function. Teams generally consist of a Planning Team Leader, Refuge Manager and staff biologists, a State natural resource agency representative, and other appropriate program specialists (e.g., social scientist, ecologist, and recreation specialist). Other Federal and Tribal natural resource agencies are asked to provide team members, as appropriate. The planning team prepares the CCP and appropriate NEPA documentation. (Service Manual 620 FW 1.6)

Plant Alliance. A vegetation classification unit containing one or more associations, defined by the presence of diagnostic species, including some from the dominant growth form or layer, and moderately similar composition that reflect regional to subregional climate, substrates, hydrology, moisture/nutrient factors, and disturbance regimes. For example, the Basin Big Sagebrush Shrubland and Steppe Alliance. (NVCS)

Plant Association. A vegetation classification unit defined by the presence of diagnostic species, usually from multiple growth forms or layers, and more narrowly similar composition that reflect topo-edaphic climate, substrates, hydrology, and disturbance regimes. For example, Artemisia tridentata ssp. tridentata / Hesperostipa comata Shrubland (Basin Big Sagebrush /Needle-and-Thread Shrubland). (NVCS)

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. Corresponds to mid-level hierarchy (Macrogroup) in the NVCS, e.g. Great Basin and Intermountain Tall Sagebrush Shrubland and Steppe.

Plant Group. Combinations of relatively narrow sets of diagnostic plant species (including dominants and co-dominants), broadly similar composition, and diagnostic growth forms that reflect regional mesoclimate, geology, substrates, hydrology and disturbance regimes (NVCS). For example, the Intermountain Mesic Tall Sagebrush Shrubland and Steppe Group.

Preferred Alternative. This is the alternative determined [by the decision maker] to best achieve the refuge purpose, vision, and goals; to best contribute to the Refuge System mission; to best address the significant issues; and to be consistent with principles of sound fish and wildlife management.

Prescribed Fire. Any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist, and NEPA requirements (where applicable) must be met, prior to ignition (National Wildfire Coordinating Group Glossary of Wildland Fire Terminology)

Presettlement Conditions: In Idaho, the state of the environment at the time of Euro-American settlement or 1800. Also see Historic Conditions.

Priority Public Uses. Hunting, fishing, wildlife observation and photography, environmental education and interpretation, where compatible, are identified under the National Wildlife Refuge System Improvement Act of 1997 as the six priority public uses of the National Wildlife Refuge System.

Public. Individuals, organizations, and groups; officials of Federal, State, and local government agencies; Indian tribes; and foreign nations. It may include anyone outside the planning team. It includes those who may or may not have indicated an interest in Service issues and those who may be affected by Service decisions.

Refuge Operating Needs System (RONS). A national database of unfunded refuge operating needs required to meet and/or implement station goals, objectives, management plans, and legal mandates. It is used as a planning, budgeting, and communication tool describing funding and staffing needs of the Refuge System.

Refuge Purpose(s). The purposes 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. For refuges that encompass congressionally designated wilderness, the purposes of the Wilderness Act are additional purposes of the Refuge. (Service Manual 620 FW 1.6)

Residual Cover. In pastures, grasslands, or emergent wetlands, tall decadent grass and/or forbs or emergent vegetation (e.g. cattail, bulrush) left standing through the fall and winter seasons.

Resistant. An ecosystem or community is described as “resistant” when it maintains its structural and functional attributes in the face of stress and disturbances.

Resilient. "Resilience" describes the ability of an ecosystem to regain structural and functional attributes that have suffered harm from stress or disturbance.

Resource of Concern (ROC). 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. (FWS Habitat Management Planning policy, 620 FW 1.4)

Restore. To bring back to a former or original condition. (Webster's II)

Revenue Sharing. Service payments (government lands are exempt from taxation) made to counties in which national wildlife refuges reside. These payments may be used by the counties for any governmental purpose such as, but not limited to, roads and schools. (USFWS Revenue sharing pamphlet)

Riparian. Refers to an area or habitat that is transitional from terrestrial to aquatic ecosystems; including streams, lakes wet areas, and adjacent plant communities and their associated soils which have free water at or near the surface; an area whose components are directly or indirectly attributed to the influence of water; of or relating to a river; specifically applied to ecology, "riparian" describes the land immediately adjoining and directly influenced by streams. For example, riparian vegetation includes any and all plant life growing on the land adjoining a stream and directly influenced by the stream.

Ruderal. Plant communities that are constituted primarily of non-native species, such that reconstructing the original vegetative community of the area is difficult.

Shallow Emergent Marsh. Shallow emergent bulrush/cattail and alkali bulrush habitats are extensive semi-permanently to seasonally flooded habitats. While the shallow emergent is structurally similar to the deep bulrush emergent marsh, it is buffered by dense stands of deep emergent hardstem bulrush and therefore lacks immediate connectivity to open water/submerged aquatic habitats. Therefore, shallow emergent habitats are not considered a tall emergent component of the "hemi-marsh."

Shelterbelt. Plantings of single or multiple rows of trees or shrubs that are established to protect or shelter nearby leeward areas from troublesome winds. Such plantings are used to reduce wind erosion, protect growing plants (crops and forage), manage snow, improve irrigation efficiency, protect structures and livestock, provide wildlife habitat, improve aesthetics, and provide tree or shrub products.

Shorebirds. Sandpipers, plovers, and their close relatives of similar size and ecology, often associated with coastal and inland wetlands. (Sibley Guide to Birds 2000)

Songbirds (Also **Passerines**). A category of medium to small, perching landbirds. Most are territorial singers and migratory.

Source. An extraneous factor that causes a stress (the most proximate cause). (TNC 2000)

Species of concern (Federal). An informal term referring to a species that might be in need of conservation action. This may range from a need for periodic monitoring of populations and threats to the species and its habitat, to the necessity for listing as threatened or endangered. Such species receive no legal protection and use of the term does not necessarily imply that a species will eventually be proposed for listing. (FWS, Endangered Species Glossary)

State. In community ecology, a "state" refers to recognizable, resistant and resilient complex of two components: the soil base and the vegetation structure (Stringham 2003).

Step-down Management Plan. A plan that provides specific guidance on management subjects (e.g., habitat, public use, fire, safety) or groups of related subjects. It describes strategies and implementation schedules for meeting CCP goals and objectives. (Service Manual 620 FW 1.6)

Strategy. A specific action, tool, technique, or combination of actions, tools, and techniques used to meet unit objectives. (Service Manual 620 FW 1.6)

Stress. Something which impairs or degrades the size, condition, or landscape context of a conservation target, resulting in reduced viability. (The Nature Conservancy 2003)

Tall Emergent Wetland. Comprises permanently flooded open and submerged aquatic vegetation immediately proximate to semi-permanently flooded deep emergent hardstem-bulrush vegetation and semi-permanent to seasonally flooded shallow emergent alkali-bulrush/cattail vegetation.

Target. See Conservation Target.

Threat. The combined concept of ecological stresses to a target and the sources of that stress to the target. (The Nature Conservancy 2003)

Threatened Species (Federal). An animal or plant species likely to become endangered within the foreseeable future throughout all or a significant portion of its range. (FWS, Endangered Species Glossary)

Total Maximum Daily Load (TMDL). A calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards, and an allocation of that amount to the pollutant's sources (US EPA). Pollutants may include sediment, nutrients (e.g., nitrogen and phosphorus), pathogens (e.g., *E. coli* bacteria), pesticides, and heavy metals (e.g., mercury).

Turbidity. The amount of particulate matter that is suspended in water, measured in NTUs (nephelometric turbidity units). Clear water generally measures less than 10 NTU.

Vegetation Type (Also see **Plant Association**). A land classification system based upon the concept of distinct plant associations.

Vision Statement. A concise statement of what the planning unit should be, or what we hope to do, based primarily upon the Refuge System mission and specific refuge purposes, and other mandates. The vision statement for the Refuge is tied to the mission of the Refuge System; the purpose(s) of the Refuge; the maintenance or restoration of the ecological integrity of each refuge and the Refuge System; and other mandates. (Service Manual 620 FW 1.6)

Waterfowl. Resident and migratory ducks, geese, and swans.

Water quality. A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose.

Watershed. The land area that drains water to a particular stream, river, or lake. It is a land feature that can be identified by tracing a line along the highest elevations between two areas on a map, often a ridge. Large watersheds, like the Mississippi River basin contain thousands of smaller watersheds.

Wetlands. Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water at some time during the growing season of each year. (Service Manual 660 FW 2; Cowardin et al. 1979)

Permanent Wetland. A wetland basin or portion of a basin that is covered with water throughout the year in all years except extreme drought.

Semi-permanent Wetland. A wetland basin or portion of a basin where surface water persists throughout the growing season of most years.

Seasonal Wetland. A wetland basin or portion of a basin where surface water is present in the early part of the growing season but is absent by the end of the season in most years.

Wet Meadows. Shallowly flooded wetland edges with little to no slope. Flooding is generally of short duration.

Wildfire. An unplanned, unwanted wildland fire including unauthorized human-caused fires, escaped wildland fire use events, escaped prescribed fire projects, and all other wildland fires where the objective is to put the fire out (National Wildfire Coordinating Group, Glossary of Wildland Fire Terminology)

Wildland Fire. Any non-structure fire that occurs in the wildland. Three distinct types of wildland fire have been defined and include wildfire, wildland fire use (allowing naturally ignited fires to burn to benefit natural resources) and prescribed fire (National Wildfire Coordinating Group Glossary of Wildland Fire Terminology)

Wildlife-dependent Recreational Use. A use of a refuge involving hunting, fishing, wildlife observation and photography, or environmental education and interpretation. These are the six priority public uses of the Refuge System as established in the National Wildlife Refuge System Administration Act, as amended. Wildlife-dependent recreational uses, other than the six priority public uses, are those that depend on the presence of wildlife. The Service will also consider these other uses in the preparation of refuge CCPs; however, the six priority public uses always will take precedence. (Service Manual 620 FW 1.6)

Appendix J. Statement of Compliance

STATEMENT OF COMPLIANCE [1]
for Implementation of the
Camas National Wildlife Refuge, Jefferson County, Idaho
Comprehensive Conservation Plan

The following executive orders and legislative acts have been reviewed as they apply to implementation of the Camas National Wildlife Refuge Comprehensive Conservation Plan.

1. **National Environmental Policy Act (1969)**. The planning process has been conducted in accordance with National Environmental Policy Act Implementing Procedures, Department of Interior and Service procedures, and has been performed in coordination with the affected public. The requirements of the National Environmental Policy Act (NEPA)(42 U.S.C. 4321 et seq.) and its implementing regulations in 40 CFR Parts 1500-1508 have been satisfied in the procedures used to reach this decision. These procedures included: the development of a range of alternatives for the CCP; analysis of the likely effects of each alternative; and public involvement throughout the planning process. An environmental assessment (EA) was prepared for the project that integrated the Draft CCP management objectives and alternatives into the EA and NEPA process. The Draft CCP/EA was released for a 30-day public comment period. The affected public was notified of the availability of these documents through a Federal Register notice, news releases to local newspapers, the Service's refuge planning website, and a planning update. Copies of the Draft CCP/EA and/or planning updates were distributed to an extensive mailing list. The CCP will be revised based on public comment received on the draft documents.

   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.

2. **National Historic Preservation Act (1966)**. The implementation of the CCP should not affect cultural resources. The proposed action does not meet the criteria of an effect or adverse effect as an undertaking defined in 36CFR800.9 and Service Manual 614 FW 2. The Service would comply with the National Historic Preservation Act if any management actions have the potential to affect any historic properties which may be present.

3. **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 Service Planners, refuge managers and Supervisors.

4. **Executive Order 13175. Consultation and Coordination with Indian Tribal Governments.** As required under Secretary of the Interior Order 3206 American Indian Tribal Rights, Federal-Tribal Responsibilities, and the Endangered Species Act, the Project Leader consulted and coordinated with the Shoshone-Bannock Tribe regarding the proposed action. Specifically, Project Leader Tracy Casselman sent an invitational letter to Chairman Small of the

Shoshone-Bannock Tribes, explaining the NWRS planning process and inviting the Tribe to participate in the CCP development process. Project Leader Casselman coordinated with the Shoshone-Bannock Tribes throughout the Service's planning process for the Refuge's Comprehensive Conservation Plan and addressed the Tribe's stated interest in big-game hunting on Camas National Wildlife Refuge.

5. **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.

6. **Wilderness Act.** The Service has evaluated the suitability of the Refuge for wilderness designation and concluded that the Camas National Wildlife Refuge does not meet the basic criteria for inclusion into the National Wilderness Preservation System.

7. **National Wildlife Administration Act of 1966, as amended by The National Wildlife Refuge System Improvement Act of 1997 (16 U.S.C. 668dd-668ee). T**he refuge manager determined that the following refuge use(s) are appropriate, and directed that compatibility determinations be completed for each use: research; agriculture (farming and haying); dog walking; and bicycling, cross-country skiing, and snowshoeing. The following uses were found to compatible, with stipulations: Environmental Education, Interpretation, Wildlife Observation, and Photography; Waterfowl Hunting; Upland Game Bird Hunting; Big Game (elk) Hunting; Research; Agricultural Practices (Farming and Haying); Dog Walking; and Bicycling, Cross-Country Skiing, Snow-shoeing.

8. **EO 13186. Responsibilities of Federal Agencies to Protect Migratory Birds.** The CCP is consistent with Executive Order 13186 because the CCP and NEPA analyses evaluate the effects of agency actions on migratory birds.

9. **Endangered Species Act.** No Federally threatened or endangered species occur on the Camas NWR. Therefore, CCP implementation is expected to result in no impacts the threatened or endangered species.

10. **Executive Order 11990. Protection of Wetlands.** The CCP is consistent with Executive Order 11990 because CCP implementation would protect and enhance existing wetlands.

11. **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 flood plains." The CCP is consistent with Executive Order 11988 because CCP implementation would protect floodplains from adverse impacts as a result of modification or destruction.

12. **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.

13. **Comprehensive Environmental Response, Compensation and Liability Act (1980) (CERCLA) and Secretarial Order 3127.** All acquisitions of real property, whether discretionary or nondiscretionary, would require a Level 1 pre-acquisition environmental site assessment. There are no Environmental Protection Agency, Region 9 Superfund sites within one mile of the project area.

14. **Uniform Relocation Assistance and Real Property Acquisition Policies Act.** The Service would conduct all realty actions in conformance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act.

______________________________ _________________________
Chief, Division of Refuge Planning Date

[1] See 602 FW 3, Exhibit 2 for other potential compliance requirements

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Appendix K. CCP Team Members

The CCP was developed primarily by core team members. The core planning team consisted of persons responsible for the preparation and completion of the Comprehensive Conservation Plan and Environmental Assessment. They are the primary strategists, analysts, and writers, and attended all team meetings. To avoid scheduling and logistical conflicts, the core team had a limited number of participants.

Professionals from several different agencies, organizations, and Fish and Wildlife Service programs, played a supporting role to the core team (Table K.2). They provided critical input early in the alternatives development process, and continued to provide review and comment as the document evolved. They provided information for use in the plan, and commented on portions of the plan within their areas of expertise. They provided technical expertise and assisted with development of objectives, strategies, and alternatives; analysis; writing; and reviewing. In addition, content specialists from other agencies or organizations were contacted as needed by members of the core team for specific planning needs.

Table K.1 Camas NWR CCP/EA Core Planning Team Members

Name	Title	Role
Tracy Casselman	Project Leader, Southeast Idaho National Wildlife Refuge Complex	Southeast Idaho NWRC decision-making; public involvement; reviewer; compliance with NEPA, ESA, NHPA etc.; outreach including Congressionals and Federal, State, and local interagency coordination; Tribal coordination.
Brian Wehausen	Refuge Manager, Camas National Wildlife Refuge	Planning team leader and primary decision maker. Coordination and development of the CCP. Key contact for public involvement. Writer/reviewer of: refuge purposes; historic and existing management practices; EA alternatives; goals and objectives; impacts assessment; compatibility determinations; implementation analysis.
Mike Fisher	Supervisory Wildlife Biologist, Southeast Idaho National Wildlife Refuge Complex (Retired)	Assess and compile biological data and write elements of CCP pertaining to biological resources and habitat management. Assist Refuge Manager in identifying issues and writing sections on: management issues; affected environment (wildlife and habitat); biological goals and objectives; compatibility determinations; and the impacts analysis of management alternatives.
Carl Mitchell	Wildlife Biologist, Southeast Idaho National Wildlife Refuge Complex (Retired)	As above
Pam Johnson	Wildlife Biologist, Southeast Idaho National Wildlife Refuge Complex	As above; hunt plan development

Bill Smith	Wildlife Biologist, Southeast Idaho National Wildlife Refuge Complex, and Refuge Manager, Grays Lake National Wildlife Refuge	CCP/EA coordination and development. Lead/facilitate core team and extended team meetings, and Regional Office briefings. Assist with public involvement including public meetings, FR notices, briefing statements, planning updates. Write, edit, and review draft CCP and other documents. Primary writer for biological goals, objectives, and rationale; impacts analysis.
Ken Morris	Conservation Planner, Planning Branch, National Wildlife Refuge System, Pacific Region	CCP/EA coordination and development. Lead/facilitate core team and extended team meetings, and Regional Office briefings. Assist with public involvement including public meetings, FR notices, briefing statements, planning updates. Write, edit, and review draft CCP and other documents. Primary writer for visitor services goals, objectives, and rationale. Assess and compile data pertaining to public use, visitor trends, Refuge history, and write elements of CCP pertaining to physical and human environment.

Table K.2 Extended Planning Team and Reviewers

Name	Title	Area of Assistance
U.S. Fish and Wildlife Service (USFWS) Pacific Region		
Robyn Thorsen	Regional Director	Final decision-maker; CCP/EA approval.
Robin West	Regional Chief, National Wildlife Refuge System	Major decisions on CCP direction.
Ben Harrison	Deputy Regional Chief, National Wildlife Refuge System	CCP advisor and reviewer; purposes; compatibility determination review
Bob Flores	National Wildlife Refuge Supervisor	Refuge workload assistance; reviewer; decision-maker
Chuck Houghten	Chief, Division of Planning, Visitor Services and Transportation (to April 6, 2013); Chief, Division of Realty and Refuge Information (April 7, 2013 on)	Reviewer; CCP quality and consistency; Regional Office liaison
Scott McCarthy	Conservation Planning Chief, Planning Branch	Reviewer; CCP quality and consistency; Regional Office liaison
Kevin O'Hara	Conservation Planner, Planning Branch	Review of effects analysis
Kevin Kilbride	Regional Inventory and Monitoring Coordinator, Branch of Refuge Biology, Division of Natural and Cultural Resources	Assists with development and review of wildlife and habitat goals, objectives, strategies, and alternatives; IPM Plan.

Joe Engler	Regional Refuge Biologist, , Branch of Refuge Biology, Division of Natural and Cultural Resources	Assists with development and review of wildlife and habitat goals, objectives, strategies, and alternatives; review of compatibility determinations; wilderness review; hunt plan review.
Bridgette Flanders-Wanner	Regional Refuge Biologist. , Branch of Refuge Biology, Division of Natural and Cultural Resources	Assists with development and review of wildlife and habitat goals, objectives, strategies, alternatives.
Tom Miewald	Landscape Ecologist & Data Coordinator, Science Applications and Refuges North Pacific Landscape Conservation Cooperative	Assists with production of maps for CCP/EA, planning updates, and agency/public involvement. Assists with GIS data layer development and production of working maps.
Gary Ball	Hydrologist, Div. of Engineering, Water Resources Branch	Water resources and rights; assists with development of strategies for water resources protection.
Pam Benn	Realty Specialist, Division of Realty and Refuge Information	Refuge acquisition history and other realty issues.
Russell Haskett	Federal Wildlife Officer, Southeast Idaho National Wildlife Refuge Complex	Review of LE and visitor services sections.
Lance Roberts	Fire Management Officer, Southeast Idaho National Wildlife Refuge Complex	Fire program guidance.
Farrel Downs	Heavy Equipment Operator, Camas National Wildlife Refuge	Provides information on current Refuge maintenance, facilities, and visitor services.
Mike Marxen	Chief of Visitor Services and Communications, Branch of Visitor Services	Assists with development and review of visitor services goals, objectives, alternatives, and strategies.
Mike Green	Nongame Landbird Conservation, Division of Migratory Birds	Assists with development and review of goals/objectives/strategies for migratory birds, esp. Flyway perspective.

U.S. Fish and Wildlife Service (USFWS), Other Regions/Offices		
LouAnn Speulda-Drews	Historian/Historical Archeologist, Nevada Fish and Wildlife Office, Reno NV	Historic/cultural advice, data, and review; cultural resource plan; SHPO consultation.
Erin Carver	Economist, USFWS Division of Economics, Arlington VA	Socioeconomic analysis
Kathi Stopher	Instructional Systems Specialist, Bear River Migratory Bird Refuge, Brigham City, UT	Visitor services review, visitor services goals and objectives

Idaho Department of Fish and Game		
Steve Schmidt	Regional Supervisor	State interests, hunting, elk management
Daryl Meints	Regional Biologist	Hunting, elk management
Terry Thomas	Regional Habitat Manager	Biological review, Alternatives development, hunt plan review
Curtis Hendricks	Mud Lake Wildlife Management Area Manager	Biological review, Alternatives development
Rob Cavallaro	Non-Game Biologist	Biological review, Alternatives development
Lew Huddleston	Senior Conservation Officer	Review of hunt plan, law enforcement
Shoshone Bannock Tribe		
Yvette Tuell	Environmental Coordinator	Tribal interests, review
SWCA Environmental Consultants		
Malini Roberts	Technical Editor	Technical editing

Appendix L. Public Involvement

Public involvement was sought throughout the development of the Draft CCP, starting in summer 2010 with the preparation of an Outreach and Communication Plan. The Refuge also held two open houses; sent letters and planning updates to inform the public, Tribes, and agencies, invite discussion and solicit feedback; and consulted with the State of Idaho and the Shoshone-Bannock Tribes.

A mailing list of approximately 160 persons and organizations is maintained at the Refuge 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 public involvement efforts.

L.1 Agency Consultation and Coordination

The Idaho Department of Fish and Game (IDFG) was invited to the public scoping meetings and asked to submit comments during public scoping. On November 5, 2010, Project Leader Tracy Casselman sent invitational letters to Idaho Department of Fish and Game Regional Supervisor Steve Schmidt (Upper Snake Region) explaining the NWRS planning process and inviting the department to participate in the CCP development process. Project Leader Casselman met with IDFG Regional Supervisor Schmidt in October 2011 and April 2012, and April 2013 to discuss hunting programs on the Refuge. Following the April 2012 meeting, IDFG Regional Biologist Daryl Meints was assigned to review and comment on portions of the Draft CCP pertaining to elk management and hunting programs. IDFG provided comments on portions of the Draft CCP. In addition Project Leader Casselman informed IDFG of progress on CCPs for the Southeast Idaho Refuges and other items of shared management interest on a regular basis (typically once per month). IDFG was involved in development of public use (hunting) alternatives and the Hunt Plan (Appendix M of the CCP), and reviewed and provided comments on the Draft CCP/EA.

L.2 Native American Government Consultation

In accordance with Service and NEPA policy, the Service invited the federally recognized Shoshone-Bannock Tribes to participate in the CCP process at the scoping or development phase. On November 5, 2010 Project Leader Tracy Casselman sent invitational letters to Chairman Small of the Shoshone-Bannock Tribes explaining the NWRS planning process and inviting the Tribe to participate in the CCP development process for the Southeast Idaho refuges, including Camas NWR. Project Leader Casselman met with the Shoshone-Bannock Tribe regarding the Camas CCP on October 18, 2011, May 23, 2012, January 25, 2013, February 26, 2013, and April 24, 2013 and met with the Tribe's natural resource staff on August 19, 2013. The Tribe provided comments on portions of the Draft CCP. Project Leader Casselman also meets with the Shoshone-Bannock Tribe twice yearly to discuss ongoing projects in the Southeast Idaho Complex (including CCPs) and discuss items of shared management interest.

L.3 Formal Scoping

3.3.1 Notice of Intent

The Service began the public scoping period by publishing a Notice of Intent to prepare the CCP in the *Federal Register* on September 17, 2010. In addition to basic information about the CCP/EA project, the notice provided information on the planning process; public involvement opportunities; a history and description of Camas NWR; and a description of the initial issues, concerns and opportunities as developed by the Service. The 30-day comment period ended on October 17, 2010.

During scoping a total of 40 responses were received from individuals or organizations from August 25, 2010 through October 18, 2010. Two State of Idaho agencies, the Department of Fish and Game and Department of Parks and Recreation, and one Federal agency, the Environmental Protection Agency, provided written comments. Of the comment forms provided at the open house meetings, 22 were returned by mail or hand delivered to the Refuge. Verbal comments from eight of the twelve attendees of the open houses were recorded. Four additional responses were received by e-mail and four written letter responses were received by mail. Results of scoping were shared with the public in Planning Update 2.

3.2.2 Other Public Notices

- August 2010. Press releases notifying the public of the open house were sent to and published by the Post-Register (Idaho Falls), the Jefferson Star (Jefferson County), and on the Fish and Wildlife Service listserv.

3.3.3 Public Scoping Open Houses

The Service held two CCP open house meetings in, in Hamer, Idaho on August 25, 2010 and Idaho Falls, ID on August 26, 2010. The public scoping meetings were in an open house format. Refuge staff 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. The public was invited to submit comments either in writing or verbally. The attendees then had the opportunity to visit four tables staffed by Complex and Refuge staff and the lead planner to ask questions and submit comments. Each table had a scribe to record verbal comments. A total of 12 private citizens attended the two open house meetings.

L.4 Other Meetings

- July 19-20, 2010. Representatives from the Service's Pacific Region updated the Idaho Department of Fish and Game (IDFG) on the status of CCP efforts in Idaho, including Camas NWR, at the annual conference of the Western Association of Fish and Wildlife Agencies.
- August 2, 2011. Preliminary draft alternatives briefing for Region 1 Refuges Chief and staff, USFWS Regional Office, Portland, OR.
- January 26, 2012. Preliminary Goals and Objectives briefing for Region 1 Refuges Chief and staff, USFWS Regional Office, Portland, OR.
- February 19, 2013. Internal draft CCP briefing for Region 1 Refuges Chief and staff, USFWS Regional Office, Portland, OR.
- September 4, 2013. Draft CCP briefing for Region 1 Refuges Chief and staff, USFWS Regional Office, Portland, OR.

L.5 Planning Updates

As noted above, the Service distributed a planning update (summarized below) to individuals, agencies, and organizations on a mailing list to initiate the scoping process. A second update was released upon conclusion of the formal scoping process, and a third update was released to announce the availability of the draft CCP and summarize management alternatives.

- August 10, 2010. Planning Update 1 sent to a mailing list of approximately 112 recipients, including private individuals, government agencies, and non-governmental organizations. Planning Update 1 provided an overview of the CCP process, announced the start of the planning process, and presented draft issues that might be addressed in the CCP. The planning update included a comment form. 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.
- January 2011. Planning Update 2, summarizing the results of public scoping, was distributed to a mailing list of approximately 160 recipients. In addition, the Planning Update and a detailed report on the results of public scoping were posted on the refuge website.
- May 2012. Planning Update 3, describing preliminary draft alternatives for the CCP, was distributed to a mailing list of approximately 160 recipients. The update summarized the draft CCP alternatives and wildlife, habitat, and public use goals, objectives, and strategies for Camas NWR.
- November 2013. Planning Update 4, announcing the availability of the Draft CCP and Environmental Assessment and the start of the public comment period, was distributed to a mailing list of approximately 160 recipients. Planning Update 4 included a summary comparison of the three alternatives presented in the Draft CCP/EA, and information on how the interested public could provide comments. CDs containing the complete Draft CCP/EA were mailed with the planning update. In addition, the Planning Update and the Draft CCP/EA were posted on the refuge website.

L.6 Other Tools

- August 2010: Comment form sent to approximately 112 people in conjunction with Planning Update 1. The comment form was also posted on refuge website, and distributed during the public scoping meetings.

L.7 Federal Register Notices

- September 17, 2010: Federal Register published Notice of Intent to Prepare a Draft Comprehensive Conservation Plan and Environmental Assessment (75 FR No. 180 57053-57055).

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Appendix M. Draft Hunt Plan for the Camas National Wildlife Refuge

JEFFERSON COUNTY, IDAHO

December 2013

Submitted By:
Project Leader

Signature **Date**

Concurrence:

Refuge Supervisor

Signature **Date**

Chief, Office of Refuge Law Enforcement

Signature **Date**

Approved:

Regional Chief, National Wildlife Refuge System

Signature **Date**

For further information, Contact:
Refuge Manager
U.S. Fish and Wildlife Service
Camas National Wildlife Refuge
2150 E. 2350 N.
Hamer, Idaho 83425-5030

Table of Contents

Draft Hunt Plan for the Camas National Wildlife Refuge

I. INTRODUCTION

Camas National Wildlife Refuge (Refuge) is located northwest of the town of Hamer, in Jefferson County, Idaho. The Refuge is situated in the Upper Snake River Plain and sits at an elevation of approximately 4,800 feet. The Refuge is at the northern edge of the Snake River Plains, a vast region of flat to gently rolling sagebrush hills which covers the southern third of Idaho. The area is surrounded on three sides by mountain ranges, the Tetons and Centennials to the east and north and the Beaverhead, Lemhi and Lost River ranges to the northwest and west.

The Refuge contains 10,578 acres with about 60% being various wetland types, ranging from sub-irrigated meadows to open water lakes. Approximately 160 acres can be used for producing cereal grains and alfalfa to provide food for migrating waterfowl and waterbirds. The remaining 4,000 plus acres of upland are sage-steppe and grassland (hayed) habitats. Camas Creek runs through the Refuge for approximately 10 miles. The Refuge is bordered by Bureau of Land Management (BLM) on its western boundary and by mostly private farm land along the rest of its boundary.

Historically, the Refuge was a wet meadow complex fed by Camas Creek, which originates near the Centennial Mountains on the Continental Divide. Historically, in periods of high snowmelt, Camas Creek would overtop its banks and inundate the surrounding area, creating seasonal wet meadow habitat. Permanent water was limited, however, until flood irrigation on the Egin Bench, 15 miles to the east, raised the water table of the Mud Lake Basin. This caused water to back up onto the present-day Refuge, and created many seeps, springs, and artesian wells that kept water flowing in the wetlands for most if not all of the year during abundant water years. These were the conditions that existed when the Refuge was established in 1937. Artificial wetlands were easily created on the Refuge, and water levels could be quickly raised by pumping relatively small amounts of water into diked units.

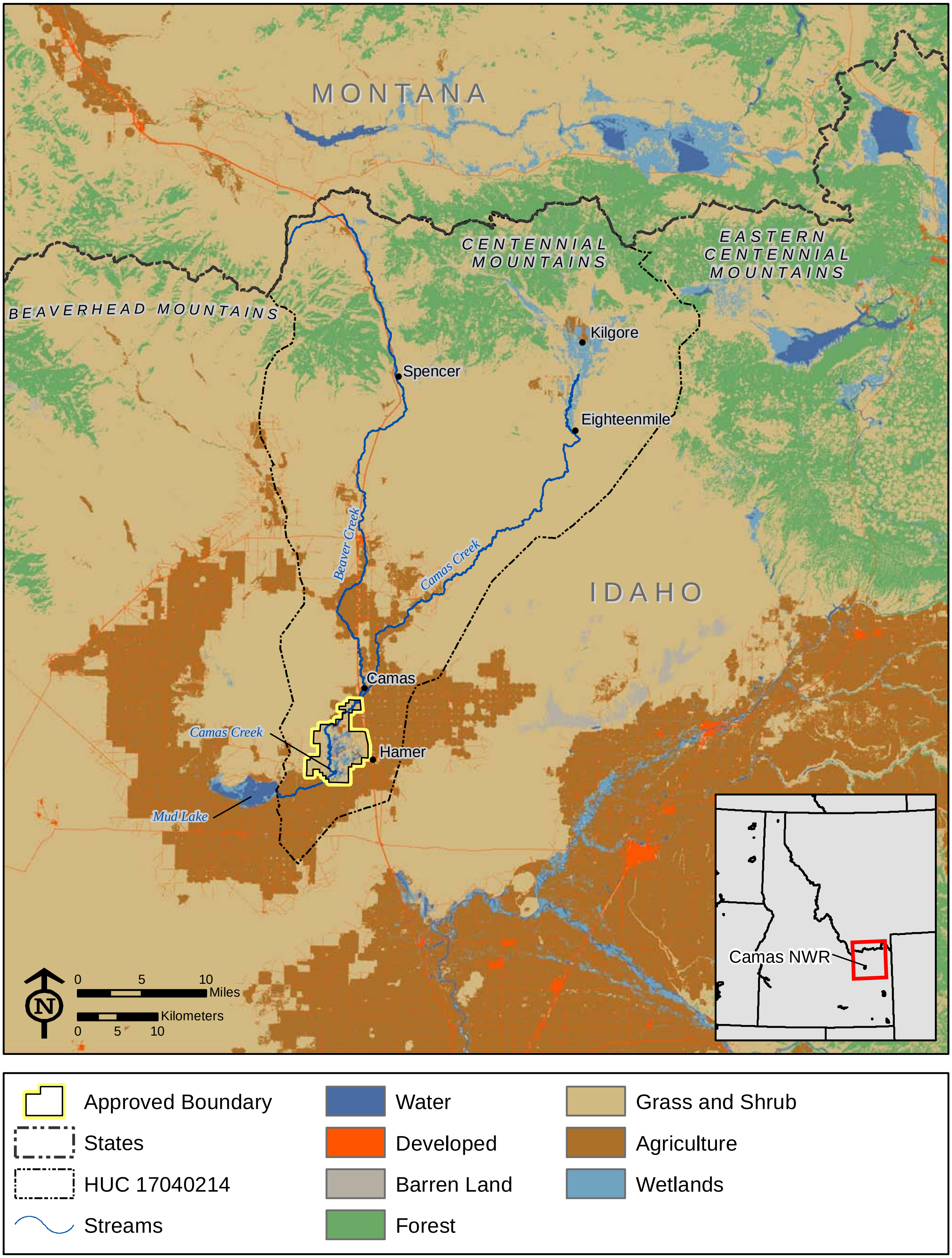
With the advent of center pivot irrigation, cessation of flood irrigation on the Egin Bench in 1980, and a ten-year drought, the water table in the Camas area has dropped 15 to 20 feet in the past 20 years. Wetlands that once perched on saturated soils have become difficult to maintain. To date about 25% of managed wetlands have been placed in “inactive” status due to their inability to hold water. The Refuge has become dependent on irrigation from wells to keep any remaining wetlands hydrated long enough for brood rearing to occur. As the water table lowered, the Refuge has had to pump increasing amounts of well water to fill certain wetland basins. In addition, Camas Creek no longer overflows its banks because of the incision of its channel. On and off the Refuge, the creek channel has been dredged deeper in order to prevent certain lands and buildings from being flooded. Increasingly, Refuge staff has been forced to look at new strategies for managing wetland habitat.

Despite these changes over time, Camas National Wildlife Refuge still provides quality habitat for more than 250 species of birds and various mammals, reptiles, amphibians, common to western sagebrush-steppe, meadow, wetland, and riparian environments. Pronghorn, moose, elk, and white-tailed deer are commonly observed on the Refuge. Although once common to the area, mule deer are now only seen occasionally on or near the Refuge. Elk became established in the past quarter century and are increasing in numbers, at least seasonally.

During the spring, summer and fall, ducks, Canada geese and trumpeter swans use the wetland, riparian and meadow habitats for foraging, nesting and brood rearing. Snow geese and tundra swans use the wetlands and meadows during migration. Shorebirds such as American avocet, willet, Wilson's phalarope and long-billed curlew can be found along the water margins, during migration and nesting seasons. Waterbirds such as sandhill crane, eared grebe, and American coot are found in the wetlands and meadows during the spring, summer and fall. Upland birds include ring-necked pheasant and gray partridge (which are introduced non-native species) and sage-grouse (native), which are present year round in relatively low numbers.

Camas NWR currently offers hunting opportunities for ducks, geese, American coot, merganser, Wilson's snipe, ring-necked pheasant, gray partridge, and sage-grouse. The Refuge has two areas open to hunting with hunting dates, hunting hours and bag limits corresponding to State regulations. Nontoxic shot is required for all species and use of temporary blinds of natural vegetation is allowed. The Refuge is not proposing any changes to the bird hunts that currently occur. However, we propose working with Idaho Fish and Game to establish an elk hunt within the boundary of the Refuge.

Map 1. ***Camas NWR - Regional Overview***



Map Date: 2/3/2012 File: Map1_CMS_RegionalOverview.mxd
Data Source: USGS 1:24,000 National Hydrography Dataset, USGS NLCD 2006.

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II. CONFORMANCE WITH STATUTORY AUTHORITIES

Statutory authority for Service management and associated habitat/wildlife management planning on units of the National Wildlife Refuge System (NWRS) is derived from the National Wildlife Refuge System Administration Act of 1966 (Administration Act) as amended (16 U.S.C. 668dd-668ee). The National Wildlife Refuge System Improvement Act (NWRSIA, Public Law 105-57), which amended the Administration Act, provided a mission for the NWRS and clear standards for its management, use, planning, and growth.

The National Wildlife Refuge System Improvement Act recognizes that wildlife-dependent recreation uses including hunting, fishing, wildlife observation and photography, and environmental education and interpretation, when determined to be compatible with the mission of the NWRS and the purposes of the refuge, are legitimate and appropriate public uses of national wildlife refuges. Sections 5(c) and (d) of the National Wildlife Refuge System Improvement Act states that “compatible wildlife-dependent recreational uses are the priority general public uses of the NWRS and shall receive priority consideration in planning and management; and when the Secretary [of the Interior] determines that a proposed wildlife-dependent recreational use is a compatible use within a refuge, that activity should be facilitated, subject to such restrictions or regulations as may be necessary, reasonable, and appropriate.” It further states that “In providing priority public uses, refuges shall emphasize opportunities for families and their children to safely engage in traditional outdoor activities, such as fishing and hunting.” The term “compatible use” is defined as “a wildlife-dependent recreational use or any other use of a refuge that, in the sound professional judgment of the Director, will not materially interfere with or detract from the fulfillment of the mission of System or the purposes of the refuge.” The U.S. Fish and Wildlife Service’s Final Compatibility Policy pursuant to the Act delegates the responsibility of determining compatibility to the Refuge Manager with concurrence by the Regional Chief. See Appendix B in the Camas NWR Draft CCP for the Refuge Manager’s Compatibility Determination in regards to hunting on Camas NWR.

III. ASSESSMENT

A. Goal of the National Wildlife Refuge System

The goals established for the National Wildlife Refuge System are delineated below:

- To preserve, restore, and enhance in their natural ecosystems (when practicable) all animal and plant species that are endangered or threatened with becoming endangered;
- To perpetuate the migratory bird resource;
- To preserve a natural diversity and abundance of fauna and flora on Refuge lands; and
- To provide an understanding and appreciation of fish and wildlife ecology and man's role in his environment, and to provide Refuge visitors with high quality, safe, wholesome, and enjoyable recreational experiences oriented toward wildlife to the extent these activities are compatible with the purpose for which the Refuge was established.

B. Refuge Purposes

The purposes for which Camas National Wildlife Refuge was established are as follows:

- "... as a refuge and breeding ground for migratory birds and other wildlife." (Executive Order 7720, dated Oct. 8, 1937)

- "... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." 16 U.S.C. § 715d (Migratory Bird Conservation Act)

- "... conservation, management, and ... restoration of the fish, wildlife, and plant resources and their habitats ... for the benefit of present and future generations of Americans... " 16 U.S.C. § 668dd(a)(2) (National Wildlife Refuge System Administration Act)

C. Goal and objectives of Camas NWR

The goal established for Camas NWR as identified in the CCP, specific to wildlife dependent recreation and public use is:

- Increase public understanding and appreciation of wildlife, and build support for Camas NWR by providing opportunities for all visitors to participate in safe, quality wildlife-dependent recreation and education programs, while minimizing wildlife disturbance or other impacts to wildlife populations or habitats.

The objectives established for Camas NWR as identified in the Draft CCP and Environmental Assessment specific to hunting are:

- Annually provide a quality, safe migratory bird hunt program on 2,510 acres of the Refuge.
- Annually provide a quality, safe hunt for upland game birds on 2,510 acres of the Refuge.

- Annually provide opportunities for a limited number of hunters to access 4,112 acres of the Refuge for elk hunting.

  Implementation of the Hunt Plan will not detract from or interfere with the Camas NWR purposes or National Wildlife Refuge System mission. The Hunt Plan is consistent with the purpose of the Refuge and sound wildlife management principles. The hunt will contain user and administrative stipulations specified in the Compatibility Determinations for Migratory Game Bird Hunting, Upland Game Bird Hunting, and Elk Hunting. The elk hunting program will be periodically evaluated to determine if the Refuge is affording the public a quality and safe hunting opportunity. Thorough evaluations may occur at any time, and will be initiated if new information becomes available or if requested by the Idaho Department of Fish and Game, but will occur at least every 15 years. If there have been no unacceptable impacts to other wildlife populations or other public use programs, or non-mitigatable impacts to public safety, the elk hunting program will be continued. The evaluation will address any reductions, modifications, or other changes to the hunt program to rectify impacts, improve safety, and promote quality.

IV. BIOLOGICAL SOUNDNESS

Hunting is proposed for:

1. Migratory Game Birds – duck, goose, merganser, American coot, Wilson's snipe
2. Upland Game Birds – ring-necked pheasant, gray partridge, sage-grouse
3. Big Game – elk

Waterfowl and upland game birds can currently be hunted on the Refuge. In this plan we propose to open the Refuge to elk hunting. Hunting programs need to be based on healthy, sustainable populations of the species hunted. Currently all target species are considered to be at harvestable populations levels throughout the Refuge. The following is an assessment of the hunting resource on the Refuge.

Status of Migratory Game Birds on the Refuge

Hunting is currently allowed for migratory game birds, including waterfowl (ducks and geese), as well as for American coot and Wilson's snipe, within established federal and state regulations. Waterfowl and American coot are present throughout the wetlands and lakes of the Refuge. Wilson's snipe are present in the wet meadow and wetland areas.

Peak fall numbers for ducks range from 2,000 to 4,000 birds depending on the habitat conditions. Canada goose fall peaks range between 600 to 1,800 and American coot from 600 to 1,500. This data is based on a limited two year survey between 2005 and 2006.

Currently approximately 2,510 acres of wetland/meadow areas (approximately 24% of the Refuge) are open to migratory game bird hunting. A major management issue is that due to the falling water table in the region, the Refuge cannot provide enough water to fill all the wetlands that exist within the Refuge boundaries. This is the case with the areas open to waterfowl hunting. Water may be present during the spring, but it typically cannot be maintained throughout the summer and into the hunting season, therefore limiting waterfowl hunting opportunities. When this plan is reviewed, after the changes in water management described in the CCP are initiated, we will re-evaluate the size and location of the waterfowl hunt area. Depending upon wetland response to changes in water management we may consider shifting the waterfowl hunt units into areas with more reliable fall water, or enlarging the waterfowl hunt area to increase hunter opportunities. At that time consideration will also be given to maintaining closed areas for migratory birds to rest and gain necessary energy to continue migration. Areas open to migratory bird hunting would not exceed 40% of the total Refuge acres. This is in accordance with the National Wildlife Refuge System Administration Act (16 U.S.C. 668dd(d)(1)(A); the Migratory Bird Treaty Act (16 U.S.C. 703-712); and the Migratory Bird Conservation Act (16 U.S.C. 715a-715r), which state that "If a refuge, or portion thereof, has been designated, acquired, reserved, or set apart as an inviolate sanctuary, we may only allow hunting of migratory game birds on no more than 40 percent of that refuge, or portion, at any one time unless we find that taking of any such species in more than 40 percent of such area would be beneficial to the species."

The continued limited harvest of migratory game birds on the Refuge will have negligible impacts on flyway population levels, as described in the Compatibility Determination for hunting. This hunt is within State Regulations which are set within the parameters of season length and bag limit by the Pacific Flyway Council. Due to lack of reliable fall water, use of Camas NWR for migratory game bird hunting is very limited, estimated at 4 to 8 hunter visits per season.

Status of Upland Game Birds on the Refuge

Greater sage-grouse are a resident native game species. Loss of quality sagebrush habitat in the surrounding area has led to a decline in the number of sage-grouse on the Refuge. Greater sage-grouse populations are cyclic and the Table Butte population, which uses Camas NWR as part of its range, demonstrates this with total male count on lek varying from 77 to 343 over a fifteen year time frame (IDFG 2011). Sage-grouse are a Candidate Species for listing under the Endangered Species Act, but are still hunted throughout most of their range. Although literature is mixed on whether hunting is compensatory (the proportion of the population that was harvested would die from some other factor if hunting did not occur) or additive (number harvested adds to those that die from other causes), hunting of sage-grouse is permitted in Idaho.

Presently IDFG sets the hunting season every August after examining population data and comparing it to the thresholds set in the statewide conservation plan. The thresholds are as follows: Closed: if less than 100 males observed; or lek counts are less than 50% of 1996-2000 average counts; or lek data not gathered for population. Restrictive: if lek counts are between 50% and 150% of the 1996-2000 average. Standard: if lek counts exceed 150% of the 1996-2000 average. The State goal for hunting greater sage grouse is to: "Manage hunting to support the increase of sage-grouse populations in Idaho and for the sustainability of smaller, more isolated populations that may be more vulnerable to overharvest" (Idaho Sage-Grouse Advisory Committee 2006). IDFG also receives input from the nine local sage-grouse working groups that have been established in Idaho. Each local working group considers a variety of factors to make a written suggestion to the IDFG on how each season should be handled.

In recent years the Refuge has supported few sage-grouse within its boundary during the hunting season. For this reason Camas NWR may only receive one or two visits annually by hunters pursuing sage-grouse. The continued harvest of sage-grouse, following IDFG regulations, on the Refuge is not expected to reduce population levels below acceptable levels due to the very limited harvest of grouse that may occur within the Refuge boundary.

Ring-necked pheasants were introduced to the area and are not native to North America, though large populations have been sustained in many prairie and western states for over 100 years. In the 1970s and 80s pheasant numbers were high, but have declined in the last several decades due to changes in agricultural practices in the area. Prior to the 1990s most of the agriculture was flood irrigation with ditches, relatively small fields, and consequently, abundant edge habitat (e.g. brush and tall vegetation) used by pheasants for thermal and security cover. With the shift to center-pivot irrigation, fields are larger with fewer ditches. Consequently, there is very little edge habitat. This has had a negative effect on the pheasant population and it has not recovered to the high population of the earlier years. Despite the fact that the population is low compared to historic highs, it is stable, in the cyclic pattern of this species. The Refuge does not actively manage for this species nor will it enhance habitat for the sole benefit of pheasants. Changes in wetland management called for in the CCP may bring a change in vegetation cover that may improve winter survival of pheasants and thus might potentially improve hunting opportunities. In recent years an estimated 6 to 12 hunters come to hunt the Refuge for pheasant and their low harvest is expected to have an insignificant impact on the Refuge population. If good nesting and brood rearing conditions exist for several consecutive years, pheasant numbers could return to a level that would make the Refuge more attractive to pheasant hunters.

Gray partridge are another introduced, non-native species. Populations of gray partridge have met the same fate as the pheasants, due to changes in local agricultural practices. As with most upland game bird species, gray partridge populations are cyclic and in recent years, populations on the Refuge have been low but stable. In general most partridge hunting on the Refuge is opportunistic, in that hunters come to the Refuge to hunt pheasant or waterfowl and may harvest partridge if the opportunity presents itself. Since hunter harvest is expected to be extremely low, removal of gray partridge from the Refuge is not expected to affect the overall population in the area. Upswings in populations are likely to occur due to changes to habitat management proposed in the CCP, and could provide some quality hunting opportunities in the future.

Status of Elk on the Refuge

Elk are found throughout Refuge habitats, and during certain times of the year they are the most numerous big game species on Camas NWR. The first elk sighting documented on the Refuge was that of two elk in 1937, seen near Rays Lake in September. Throughout the years elk were sporadically documented on the Refuge ranging from 1 to 4 animals every 5 to 10 years. The first year that elk were documented in a group larger than 4 animals was 1994, when 27 animals were reported. Elk population surveys were first initiated in 2008 with visual surveys attempted several times a month (Table 1).

Table 1. Camas elk survey 2008-2009

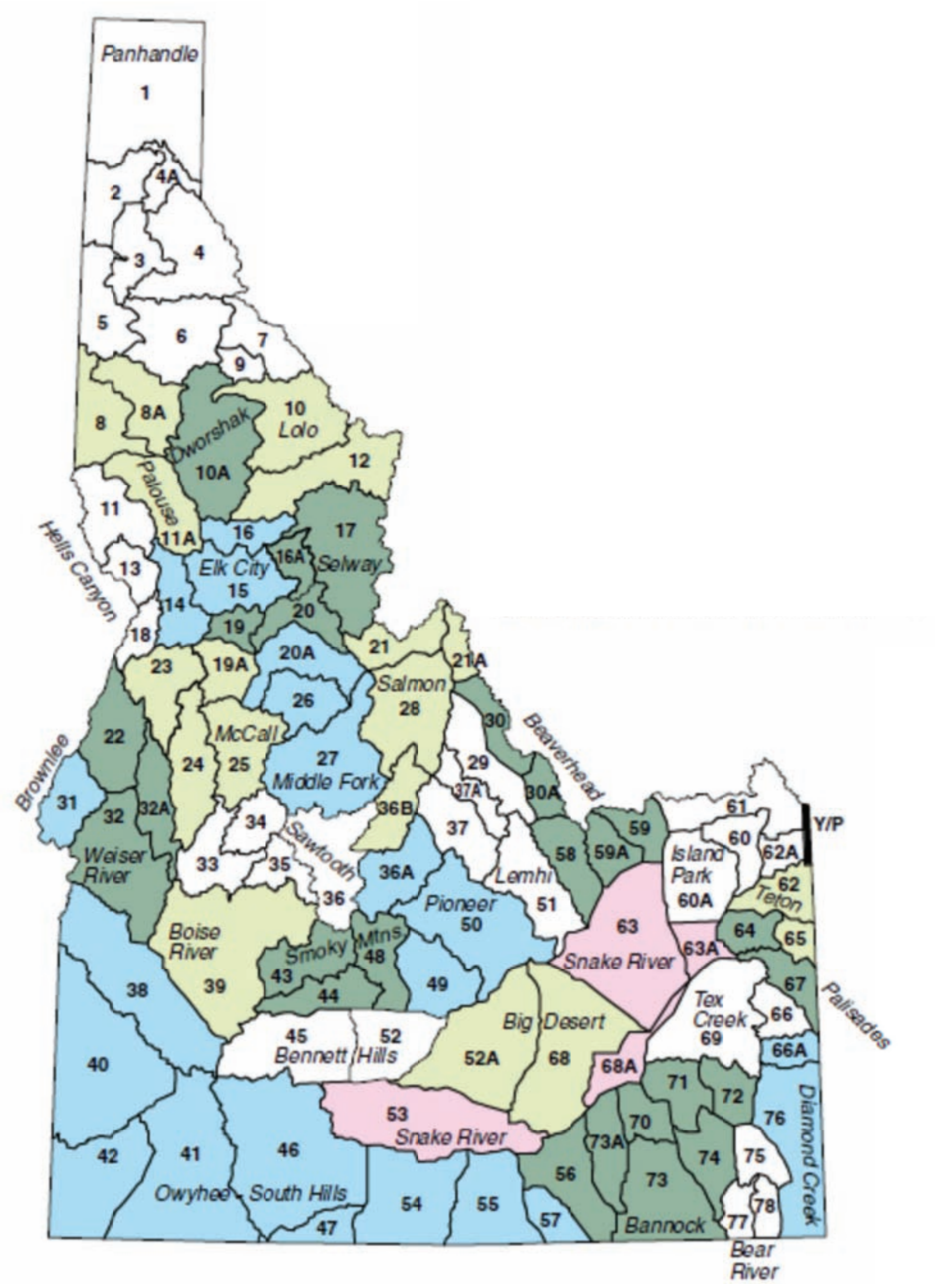
Date	Sept 08 1 count	Oct 08 5 counts	Nov 08 1 count	Dec 08 1 count	Jan 09 3 counts	Feb 09 3 counts	Mar 09 1 count	Apr 09 3 counts	May 09 2 counts
High Count	64	99	105	130	117	105	78	46	50
Low Count	64	92	105	130	38	90	78	0	6

Using the above survey data and other recent general observations, it is estimated that the Refuge supports from 0 to 150 elk seasonally. The numbers are typically highest in the fall and winter and lower in the spring and summer. The bulk of the elk spend their time south of the auto tour route, primarily around Rays Lake. It is possible that a small number of these elk are a resident to the area in around the Refuge, while other elk using the area solely as a wintering ground. It has been speculated that elk migrate into the Refuge from two directions: animals coming south across Highway 22 out of the Beaverhead Mountain Range, and animals coming from the Island Park/Yellowstone area and crossing Interstate 15.

IDFG has an Elk Management Plan (1999) which functions as the action plan for elk management in the state. Across the State of Idaho, approximately 70% of the herds are at or above population objectives (IDFG 2012). Management objectives, historical perspectives, and issues associated with habitat, biology, inter-specific competition, predation, and winter feeding are addressed in this plan for 28 of the 29 elk management zones. In Idaho, elk management zones are further subdivided into smaller units called game management units (GMUs). The Snake River Zone (Game Management Units 53, 63, 63A, 68A), encompasses Camas NWR. The boundary of Camas NWR lies within the GMU 63 which is a smaller division of the Snake River Zone (see Map 2 below). GMU 63 is 2,008 square miles and is characterized as 30% agriculture, 60% rangelands, 0.25% urban, 8% rock and 1.75% riparian (IDFG 2012b).
A revised plan for 2014-2024 was released for public comment in August 2013, and is due to be finalized in the fall of 2013. IDFG's proposed 10-year management direction for the Snake River Zone is as follows: "Management direction in the Snake River Zone involves decreasing the current elk population. The zone is dominated by agricultural lands and small communities that are not compatible with large numbers of resident elk. It is proposed to continue managing for minimal elk numbers by using long, liberal hunting seasons and prompt responses to crop and property damage on agricultural lands" (IDFG 2013, Draft Idaho Elk Management Plan 2014-2024). There is no numeric population objective for the Snake River Zone.

Historically GMU 63 had depredation hunts but since these hunts were occurring every year, IDFG decided to initiate an annual controlled hunt (Meints 2012). For the past 15 years this unit has had one of Idaho's longest, most liberal (5 months long) elk hunting seasons. In 2011, GMU 63 was managed for a general elk season allowing only A-tag hunts. The general A-tag hunt for GMU 63 in 2011 was an any-weapon, any-elk hunt from August 1 through August 31, and an any-weapon, antlerless only hunt from September 1 through December 31. An annual controlled hunt for elk is also offered and has been available for the last three years in a subsection of GMU 63, called GMU 63x. This unit is defined as that portion of GMU 63 north of State Highway 33. The hunt runs from Jan 1st to Feb 15th each year and in 2012 offered 25 antlerless elk permits.

Map 2. Idaho Game Management Units (GMUs). Camas NWR lies within GMU 63.



Source: IDFG, 2013 Big Game Seasons and Rules.

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IDFG estimated a population of 380 elk in the Snake River Zone in 2011 (IDFG 2011). Total harvest on GMU 63 has ranged from 70 to 257 annually, and the harvest increased annually until 2010 (Meints 2012). The harvest dropped markedly in 2011. However, one factor influencing the 2011 harvest may have been mild weather conditions; therefore harvest data does not necessarily indicate lower population levels. Harvest data for GMU 63 is tabulated below in Table 2 below.

Table 2. GMU 63 Elk Harvest Data (Source: IDFG 2012b)

Year	Hunters	Total Harvest	Bulls	Cows
2011	684	70	27	43
2010	755	257	58	199
2009	603	138	39	99
2008	598	155	37	118
2007	496	112	47	65
2006	327	107	22	85

(Source: IDFG 2012b, General Hunt Harvest Statistics, Elk (Wapiti) 2006-2011.
URL: http://fishandgame.idaho.gov/ifwis/huntplanner/stats.aspx#elk)

Disease issues (e.g. brucellosis) are also a concern with the elk in Unit 63. Brucellosis has been found in the Island Park herd and IDFG is working with cattle ranchers to address this threat. At this time IDFG has no documentation of brucellosis on the west side of Interstate 15. However IDFG continues to opportunistically test elk from GMU 63, often requesting samples from hunters (Meints 2012). Chronic wasting disease has not been documented in Idaho but approximately 400 animals are tested every year in Southeastern Idaho (Meints 2012).

V. DESCRIPTON OF HUNTING PROGRAM

The migratory game bird and upland game bird hunting programs on Camas NWR would provide a quality, safe hunting opportunity that minimizes negative impacts to habitat and nontarget species.

The proposed elk hunt on Camas NWR would offer a quality, safe recreational hunting opportunity that: (1) minimizes impacts to habitats and nontarget species; 2) maintains and improves riparian habitat condition on the Refuge; and 3) assists the IDFG in reducing the elk population locally, in order to alleviate depredation concerns on surrounding private lands. The proposed hunt would offer the public, particularly mobility impaired and youth hunters, a reasonable opportunity to harvest an elk. Hunting may improve riparian habitat condition by direct reduction of herd size and by dispersing elk from riparian habitat. The elk hunt may alleviate localized depredation issues by reducing the elk population, and/or dispersing elk onto adjacent private or public (BLM) lands where they may be hunted.

The Refuge has coordinated closely with the State in developing an elk hunt that falls within frameworks for the general elk hunt within GMU 63. The Preferred Alternative would assist IDFG in supporting population objectives for the Snake River Management Zone (which includes GMUs 53, 63, 63A, 68A), specifically as it applies to alleviating depredation to agricultural croplands.

A. Areas of the Refuge that support populations of the target species

Migratory Game Birds

Migratory game birds (primarily waterfowl, but also American coot and Wilson's snipe) occur in wetlands, meadows, and agricultural fields. Most fall waterfowl habitat (permanent open water for loafing, deep and shallow emergent wetland, hayed fields, and croplands) on the Refuge is located outside the two (north and south) migratory and upland bird hunting units. Approximately 40 acres of hayfields (15% of Refuge total) are located within the north hunt unit. 80 acres of croplands (50% of Refuge total) are located in the south hunt unit; however these are alfalfa fields; all grain fields are located in the non-hunting area. Due to the drop in the water table all of the wetlands in the hunt units are dry by late summer, unless water is pumped from wells. When water is flowing through the main diversion or Independent Ditch (which lie within the area open to waterfowl hunting), limited numbers of waterfowl may use these ditches. During the hunting season some waterfowl, primarily Canada geese, use Rays Lake and Sandhole Lake (both lake lie outside the migratory and upland game bird hunting units) as loafing and roosting areas.

Upland Game Birds

Upland game birds occur sporadically in sagebrush-steppe habitat, agricultural fields, and meadows.

Elk

Elk currently range throughout the Refuge. Elk tend to concentrate in the riparian willow habitat on the south end of the Refuge, primarily around Rays Lake.

B. Areas open to hunting and areas proposed for opening to hunting.

Migratory Game Birds and Upland Game Birds

Two hunting units totaling 2,510 acres currently exist on the Refuge: the north unit (approximately 980 acres) and the south unit (approximately 1,530 acres) (see Map 3). Both of these units are open to migratory and upland game bird hunting. With the completion of the CCP and new water management actions we may re-evaluate the size and location of the waterfowl and upland game bird hunting units, but the area open to migratory game bird (waterfowl) hunting would never exceed 40% (4,231 acres) of the Refuge.

Elk

The proposed elk hunt would occur on 4,112 acres of Service owned lands, generally described as the southern and western portion of the Refuge, south of the core wetlands and auto tour route, and west of Camas Creek. This area includes sagebrush-steppe, willow riparian, and wetland habitat. This area includes, and overlaps with, the current south hunt unit (1,530 acres). Under the Preferred Alternative of the Draft CCP, the elk hunt area would remain open to public uses other than hunting, during the hunting season. These uses are: hiking, bicycling, cross country skiing and snowshoeing on service roads; vehicle access on hunter access roads; and use of portable photography blinds within 100 feet of roads. Off road hiking, other than by hunters engaged in pursuit of game, would be prohibited on the Refuge. Map 3 illustrates the two migratory and upland game bird hunting units, and the proposed area to be opened to elk hunting under the Preferred Alternative.

In January, after the close of each season, Refuge personnel will evaluate the safety and quality aspects of this hunt and make adjustments to area closures if necessary to ensure a safe, quality hunt that minimizes impacts to sensitive non-target wildlife resources. The Refuge would implement, as needed, spatial or temporal closures to protect sensitive non-target wildlife resources such as sandhill crane roosts, or crane and trumpeter swan pairs with broods, upon detection of these resources. Of specific concern is Rays Lake, which is used as a pre-migration staging area by greater sandhill cranes. There is also a low possibility of sandhill crane pairs with colts, and trumpeter swans with broods, being present in the hunt area early in the hunt season. Upon detection, sensitive resources would be mapped and closure areas established to buffer the resource. A buffer area of 400 meters around sandhill crane roosts and wetlands with swan broods is considered necessary and appropriate should these resources be present during the hunting season.

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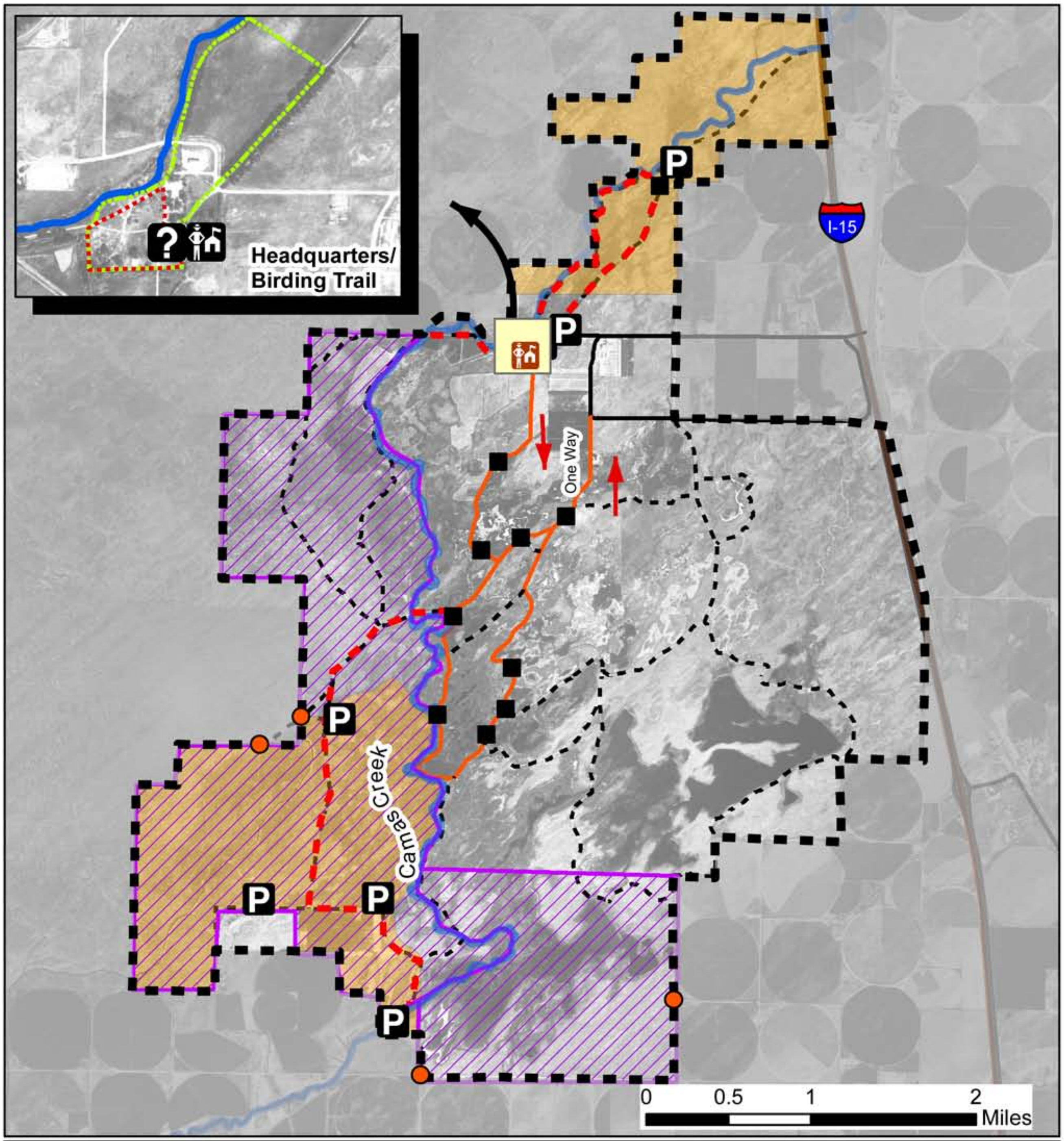
Map 3. *Proposed Refuge hunting units and public use facilities*



Legend

- Service Roads (Closed to vehicle traffic)
- Auto Tour Route
- Roads open to vehicles year-round
- Hunting and Wildlife Observation Road
- Existing Birding Trail (in inset map)
- Proposed Birding Trail
- Gate and Access
- Refuge Boundary
- Headquarters and Information
- Elk Hunt Area
- Waterfowl and Upland Bird Hunting Areas
- Info Kiosk
- Pull-out / Information Sign
- Parking

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C. Species to be taken and hunting periods

<u>Migratory Game Bird Hunt:</u>

Hunting will be allowed for ducks, geese, mergansers, American coots, and Wilson's snipe. Migratory game bird seasons will run in accordance with State of Idaho regulations. Waterfowl hunters will be allowed to enter the Refuge one hour before legal hunting hours and remain for one hour after sunset. Non-toxic shot must be used for all migratory bird hunting. Specific regulations are described below in Section VII, Part 5. Hunting dates are listed in Table 3.

<u>Upland Game Bird Hunt:</u>

Hunting will be allowed for ring-necked pheasants, gray partridge, and sage-grouse. Upland game bird seasons will run in accordance with State of Idaho regulations and seasons, with the exception that non-toxic shot must be used for hunting upland birds within the Refuge boundary. Upland game hunters will be allowed to enter the Refuge one hour before legal hunting hours and remain for one hour after sunset. Specific regulations are described below in Section VII, Part 6. Hunting dates are listed in Table 3.

<u>Elk Hunt:</u>

The season dates for hunting elk on Camas NWR would coincide with the rules for the GMU 63 hunt as specified in the Idaho Fish and Game publication Big Game Hunting Rules. Specific regulations are described below in Section VII, Parts 2, 3, and 4, and hunting dates are listed in Table 3.

The Refuge will issue up to 20 access permits for elk hunting annually. The number of access permits issued may vary from year to year and will be determined by the staff of Camas NWR in coordination with Idaho Fish and Game before the beginning of each season. Priority for the access permits will be given to youth hunters (age 12-17 at the time of application), and disabled hunters that have a mobility impairment. Mobility impaired hunters must meet at least one of the following Refuge specific criteria: 1) Have a mobility impairment resulting from permanent medical conditions which makes it physically impossible for them to hunt without the assistance of an attendant; 2) Need a medically prescribed assistive device for mobility; or 3) be at least 65 percent disabled. However, hunters that do not meet the criteria of youth or mobility impaired are encouraged to apply for access permits. If the number of youth and mobility impaired hunter applicants is less than the total number of access permits being issued in a given season, other applications will be included in the drawing for access permits.

The access permit would allow hunting on Friday, Saturday, Sunday, Monday and Tuesday. Hunters would be assigned a two-week hunt period that would be determined by random draw. Therefore, ten (10) two week hunt periods would be established throughout the season, with two hunters allowed on the Refuge per period. Applicants for access permits may request specific hunt periods. After the first season, preference will be given to those whom have not previously been issued access permits. Hunters may hunt as many days as necessary to harvest an animal within the two-week timeframe allowed under the access permit; therefore a permit would allow hunters to access the Refuge for up to ten days. Hunters who draw an access permit for August will have a chance to harvest a bull elk as per State regulations. After the drawing for access permits has occurred, hunters must attend a pre-hunt orientation with Refuge staff or trained volunteers, where they will be briefed on the hunt area boundary, safety, and other special regulations or issues that may affect the hunt (for example, avoiding disturbance to staging migratory bird flocks).

Youth hunters (aged 12-17) must be accompanied by an adult. Mobility impaired hunters may be accompanied by a non-hunting companion designated in writing in accordance with State regulations. They may be assisted by Refuge staff or a trained Refuge volunteer upon request.

Weapons used will be shoulder fired, center fire with cartridges larger than 20 caliber. No permanent structures may be constructed on Service lands. Mobility impaired hunters may use temporary hunting blinds. They will be taken to and from hunting blinds by Refuge personnel or a trained Refuge volunteer using a Refuge-owned utility terrain vehicle (UTV). Hunting from vehicles is prohibited.

Successful hunters will be allowed to move a harvested elk to the nearest established, designated Refuge road by foot. Vehicles may then be used to remove the elk from the Refuge. Refuge personnel or a trained volunteer will aid in the removal of elk harvested by mobility impaired hunters and will determine the best route for removal of game. If a wounded animal leaves the area open to elk hunting on the Refuge, the hunter (or assistant of a mobility impaired hunter) will be escorted by Refuge staff or trained volunteer to retrieve the game. If a wounded animal leaves the Refuge boundary, permission must by granted from private landowners to attempt retrieval, in accordance with Idaho laws.

Table 3. Idaho hunting seasons for huntable species at Camas NWR
(Based on State of Idaho Seasons)

Species	Season Open	Season Close	Permits Issued	Refuge Unit
Any Elk	August 1	August 31	Up to 4	Big Game
Antlerless Elk	September 1	December 31	Up to 16	Big Game
Waterfowl	October 13	January 25	NA	N & S Units
Dark and Light Geese	October 13	January 25	NA	N & S Units
Wilson's Snipe	October 13	January 25	NA	N & S Units
American Coot	October 13	January 25	NA	N & S Units
Ring-necked Pheasant	October 19	November 30	NA	N & S Units
Gray Partridge	Sept 21	January 31	NA	N & S Units
Sage-grouse	Set by IDFG in August based on lek counts (in 2012 the season in Jefferson County was September 15-September 21.)		NA	N & S Units

Sources: IDFG 2012. Elk General Zone Seasons. URL: http://fishandgame.idaho.gov/public/docs/rules/bgElk.pdf
IDFG 2012c. 2012 Waterfowl Seasons and Rules. URL: http://fishandgame.idaho.gov/public/docs/rules/waterfowlRules.pdf
IDFG 2012d. Upland Game, Furbearer, Turkey Seasons and Rules, 2012-13 and 2013-14. URL: http://fishandgame.idaho.gov/public/docs/rules/uplandRules.pdf

D. Justification for Refuge access permit for elk hunting

Our objective is a safe, quality elk hunt that minimizes negative impacts to nontarget species and Refuge resources; and minimizes conflicts with other user groups. Because of the Refuge's small size (10, 587 acres), and high level of use of certain areas of the Refuge by nonconsumptive users (for example the 6.3 mile auto tour loop), we propose to allow elk hunting within a limited footprint of 4,112 acres that lies outside the area where the majority of public use currently occurs.

To ensure a quality hunt, the number of access permits will be limited to no more than 20 annually. The number of access permits available each year will be determined by the Refuge Manager in consultation with the IDFG. Actual hunting dates on the Refuge will be coordinated between each hunter and Refuge staff so that no more than two hunters are present on the Refuge at any given time. By limiting hunter density, the permit system will promote quality, safety and un-crowded conditions; allow hunters to select a hunting location based on signs of elk activity; and distribute hunting pressure over a longer period of time.

E. Procedures for consultation and coordination with IDFG for proposed elk hunt

Mobility impaired and youth hunters with valid State elk licenses for GMU 63 must submit their application for a Refuge elk hunting access permit by the second Friday in July of each year. The draw for permits will occur on the following Monday. The Refuge Manager will coordinate through an annual meeting in May with the regional IDFG staff to discuss elk population levels in the general area and decide on the number of access permits that will be allowed for the Refuge based upon the effectiveness of the previous season's elk hunt. Refuge personnel will meet in January to evaluate the safety and quality aspects of this hunt and make adjustments to number of hunters and area closures if necessary to ensure a safe, quality hunt that minimizes impacts to sensitive non-target wildlife resources.

F. Methods of control and enforcement

A Refuge Law Enforcement Officer (shared position for the SE Idaho Complex) will assist in the hunter orientation and focus his patrol efforts on Camas during the migratory game bird, upland game bird, and elk hunting seasons. We anticipate that Service LE patrols would be needed three days per week throughout the five month elk hunting season, for a total of 60 patrol days. IDFG has pledged the assistance of their Conservation Officers if needed. Hunting areas will be posted with signs designating hunting units. A tear sheet/map of hunt units and regulations for all hunts will be developed. All elk hunters will receive a pre-hunt orientation from Refuge staff or trained volunteers. These measures would reduce the need for the presence of an LEO on site.

G. Funding and staffing requirements for the hunt

The proposed new elk hunt would not require any additional infrastructure. Hunter access to the hunting unit can be accommodated by existing parking areas and roads. Additional signage at access points to the elk hunt area, and updated information and outreach materials would be needed. Administration of the hunt plan would add some workload to existing staff. Some demands (e.g. training volunteers; updating signs and brochures) would occur in the first years of the elk hunt. Annual expenses include monitoring the impacts of the hunt program to Refuge wildlife and habitat, addressing public inquiries, interagency coordination, providing hunter orientation, assisting mobility impaired hunters, assisting with retrieval of game outside the hunt area, and additional law enforcement patrols. Approximately 50% of initial expenses and 80% of recurring expenses could be covered with existing funding, and Refuge and SE Idaho Complex staff. We would seek funding to cover additional expenses (estimated at approximately $3000 initially, and $5000 annually). The approximate expenses for implementation and management of the elk hunt program are in Table 4. Approximate expenses for management of migratory and upland game bird hunts are in Table 5.

Table 4. Estimated Initial and Annual Cost for Elk Hunt Program

Position	**Activity or Product**	**Initial**	**Reccurring**
Refuge Manager*	Coordination with IDFG and program management; hunt plan updates		$1800*
Wildlife Biologist*	Resource monitoring (e.g. , elk surveys, willow habitat) (Refuge Biologist)		$3500*
SE ID Complex Park Ranger (LEO)*	Service LE patrols (3 per week for 5 months)		$13,372*
Refuge Manager,* Park Ranger	Provide hunter orientation; assist mobility impaired hunters, assist with game retrieval outside hunt area (Refuge staff)		$3500
Regional Office staff*	Develop updated information/outreach materials (print and Web)	$1000*	
Regional Office staff,* Eng. Equip. Operator*	Sign access points to elk hunt area	$1800*	
SE ID Complex Visitor Services Manager; Park Ranger	Recruit/train volunteers to assist mobility impaired hunters	$ 3000	$1,600
Total		**$5,800**	**$23,772**

*Covered under existing funding/salaries

Table 5. Annual Hunt Program Cost for Migratory and Upland Game Birds.

Position	Activity or Product	Reccurring
Refuge Manager	Program Management	$600*
Wildlife Biologist	Resource Monitoring (e.g.sage grouse surveys)	$2,500*
SE ID Complex Park Ranger (LEO)*	Service LE patrols	$3,343*
Regional Office staff,* Eng. Equip. Operator*	Modify existing outreach/regulatory materials; signage upkeep.	$ 500*
Total		**$6,943**

*Covered under existing funding/salaries

VI. MEASURES TAKEN TO AVOID CONFLICTS WITH OTHER MANAGEMENT OBJECTIVES

A. Biological Conflicts

1. Threatened and Endangered Species

The following Federally listed or Federal candidate species have been documented on the Refuge or the surrounding landscape – Ute ladies'-tresses (Federal Threatened), yellow-billed cuckoo (Federal Candidate), greater sage-grouse (Federal Candidate), Canada lynx (Federal Threatened).

a. Ute ladies'-tresses (*Spiranthes diluvialis*)

Camas NWR is within historic range for Ute ladies'-tresses. The plant grows along riparian edges, gravel bars, old oxbows, high flow channels and moist to wet meadows along perennial streams. It typically occurs in stable wetland and seep areas associated with old landscape features within historical floodplains of major rivers (USFWS 2010). There is no known occurrence on the Refuge. Therefore hunting will have no impact on Ute ladies'-tresses.

b. Yellow-billed cuckoo (*Coccyzus americanus*)

Camas NWR is within the historic summer and breeding range for yellow-billed cuckoos. The birds prefer open woodlands with clearings and dense scrubby vegetation, often along water (Cornell University 2011). Yellow-billed cuckoos have been documented on Camas NWR in the spring and summer as a transient. It is listed as rare (known to be present but not every year) for the Refuge. All hunting occurs in the fall and winter months, therefore there should be little interaction between hunters and yellow-billed cuckoos.

c. Greater sage-grouse (*Centrocercus urophasianus*)

Camas NWR is within the historic range for sage-grouse and offers about 4,000 acres of preferred shrub-steppe habitat. Sage-grouse have been observed during all seasons and are known to nest on the Refuge. Although sage-grouse are present during the hunting seasons, with the limited number of access permits given for the elk hunt and the low numbers of upland game bird hunters, the negative impacts on greater sage-grouse from either elk hunting or upland game bird hunting should be minimal.

d. Canada Lynx (*Lynx Canadensis*)

Camas NWR is within the historic range for Canada lynx. The lynx is a secretive forest dwelling cat historically found throughout much of Canada, the forests of northern tier states, and subalpine forest of the central and southern Rocky Mountains. There have been known occupancies in Jefferson County, but the Refuge does not contain suitable habitat for lynx (Laye 2012). Therefore hunting will have no impact on Canada lynx.

2. Other Wildlife and Habitats

While hunting will occur within or adjacent to wetlands, meadows, sage-steppe, and riparian habitats, these habitats and their associated species are not likely to be impacted significantly because the hunting programs would involve a small number of widely dispersed hunters over a broad period of time; occur outside of the breeding season for most wildlife species; and occur outside of the growth and reproductive season of most herbaceous plants. Additionally, the Refuge will issue specific area closure maps as necessary to buffer critical resources from hunting impacts.

While direct impacts to habitats within the hunt areas due to hunter activity are expected to be minor, redistribution of elk due to hunting could cause indirect impacts to habitat. Current migratory and upland game bird hunting programs have minimal impacts to elk since most elk concentrate outside the current hunt areas for these species. With the inclusion of Rays Lake within the proposed elk hunting area, elk distribution in the Refuge is likely to change. Within the hunt area, impacts to riparian shrublands and wetlands in the Rays Lake area are likely to be beneficial through reduced browsing pressure on willows. Conversely, increased density of elk in the no-shooting areas may occur, increasing the intensity of browsing these areas and potentially reducing habitat condition in these areas. Vegetation monitoring will be conducted to determine if this elk hunt causes changes to elk use of the Refuge and/or changes in riparian habitat condition.

a. Elk: During hunting seasons, disturbance increase energetic costs for elk (Johnson et al. 2005). Elk within GMU 63 may incur higher energy costs due to hunter disturbance from the proposed elk hunt on Camas NWR, as the Refuge would cease to serve as a sanctuary from human disturbance and hunting pressure. This could indirectly lead to reduced body condition and reproductive fitness, as elk may deplete stored fat reserves to avoid hunters and forage on more remote and less secure BLM rangelands. It is unlikely, however, that the proposed hunt would increase winter mortality since this is not a limiting factor of the GMU 63 elk herd (Schmidt 2013).

In the proposed hunt up to 20 Refuge permits would be issued to harvest elk annually, and we assume that not all hunts will be successful. Therefore the Camas hunt would represent only a fraction of the total harvest in the GMU 63 and would not result in significant cumulative impacts to elk populations regionally or statewide. Nevertheless, an increase in harvest in GMU 63 would help reduce the local population to levels that are socially acceptable, by reducing direct financial losses to farmers. As reproductive cows are removed from the local population during the antlerless hunt, it is assumed that the Camas NWR elk hunt may assist IDFG in achieving its desired population reduction in the Snake River Zone. Direct reductions in population through hunting, combined with lower reproductive rates, could contribute to a decline in long-term herd productivity in GMU 63. However this would be in line with the IDFG's elk management objective for the Snake River Zone, including GMU 63, which is to reduce the current population through long, liberal hunting seasons and response to crop and property damage.

b. <u>White-tailed deer</u>: White-tailed deer use some of the same habitats used by elk. Numbers of white-tailed deer are usually low during the beginning of the elk season. Most the white-tailed deer that utilize Camas NWR do so during the rut (late October and November) and throughout the winter months. Also, white-tailed deer spend the majority of their time in the central part of the Refuge, outside of the proposed elk hunting area. The elk spend the bulk of the time in the southern half of the Refuge and appear to mix only when feeding after dark, after shooting hours. While disturbance to white-tailed deer may occur, these occurrences would short lived and relatively rare given the low numbers of hunters that would be present on the Refuge at any given time and the low total number of permits that would be issued during the hunt season (20 maximum).

c. <u>Waterfowl, waterbirds, and shorebirds:</u> The migratory and upland game bird hunting programs would be expected to have minimal negative effects to waterfowl, waterbirds, and shorebirds, due to the lack of water currently present in the north and south hunt units, low numbers of waterfowl, and consequently, low numbers of hunters. Level of harvest is low and represents a negligible proportion of total harvest, regionally. The proposed elk hunting program has a greater probability of disturbing waterfowl, waterbirds, and shorebirds, since Rays Lake lies within the proposed elk hunting area. The amount and degree of disturbance to waterfowl, waterbirds, and shorebirds would depend on the condition of the Refuge wetlands. If late season water is present in Rays Lake, waterfowl, mostly Canada geese, will use the lake for roosting during the elk season. Limited numbers of shorebirds may use Ray's Lake during fall migration. Periodic shooting, or hunters walking in close proximity to these wetlands, could temporarily disperse birds. This disturbance would be limited in scope by the low number of elk hunters at any given time (maximum of 2 daily). The rate of gunfire discharge is expected to be infrequent and random based upon opportunistic individual shots at elk in range. The frequency of gunfire may be only a few shots per day at most, causing temporary and short term disturbance to waterfowl, waterbirds, and shorebirds.

d. Trumpeter Swan: Disturbance of trumpeter swans with broods is a potential concern during the early portion of the elk hunting season. The young of trumpeter swans typically hatch in late June, however nesting, laying, hatching, and fledging dates of trumpeter swans vary widely even within areas, due to annual weather patterns. For example, Gale et al. (1987) give first hatching dates at Red Rock Lakes NWR, MT between May 30 and July 1 in different years, while within-year hatching dates varying by 1- 3, and exceptionally 6, weeks. In typical years swans would be fledged by mid-October. In years with late nesting, swans with cygnets may be present as late as November 1, although this is unlikely given the lack of late season water in the areas of the Refuge used by swans for brood rearing. While the proposed elk hunt could disturb trumpeter swans and their broods during the early portion of the hunting season, disturbance of swans by elk hunters is unlikely because the hunt area lies outside the area where swan nesting and brood rearing have historically occurred. In a particularly wet year, pedestrian access from elk hunters could disturb some foraging swans in the Rays Lake area. However, there is seldom enough water in Rays Lake in an average or dry year to be attractive to swans, and swans collectively spend little time in the 4,112 acre elk hunting area. There is no documentation of swans nesting or rearing broods in the proposed elk hunt area. As a precaution hunters will be required to maintain at least a 400 meter (1/4 mile) distance from wetlands where swans are rearing their broods. Hunters will be advised of the location of swans and setback distances and/or area closures during their pre-hunt orientation. As noted above, the framework of the Refuge hunt allows the Refuge to selectively close areas, as detected, to protect sensitive wildlife resources within the hunt area with spatial buffers.

e. Sandhill Crane: Greater sandhill cranes use both Rays Lake (within the proposed elk hunting area) and to a lesser degree, Sandhole Lake (which lies outside the proposed elk hunting area) as roost sites during pre-migration staging. In typical years, crane numbers at Camas NWR peak in mid-September and the majority of cranes have left the Refuge by early October. However, during open winters (no snow), low numbers of cranes have been observed on the Refuge into December. The existing migratory and upland game bird hunting programs have minimal impacts to sandhill cranes due to the low numbers of hunters pursuing these species, and the fact that Rays Lake and Sandhole Lake lie outside the hunt units. The proposed elk hunt has the potential to disturb sandhill cranes since Rays Lake is included within the proposed elk hunting area. Sandhill cranes have shown susceptibility to even low levels of disturbance at roost sites (Littlefield and Ivey 2000, Bettinger and Milner 2000). Because of the sensitivity of roosting cranes to disturbance, hunters will be advised of the location of sandhill cranes and setback distances during their pre-hunt orientation. Resource buffers will be utilized to sufficiently safeguard sandhill crane roost sites from abandonment. Hunters must maintain a distance of at least 400 meters (1/4 mile) of roosting cranes. The Refuge may also selectively close areas, as detected, to protect sensitive wildlife resources within the hunt area with spatial buffers. As closures are implemented, the Refuge will supply hunt permit holders with maps of closures to hunting activity.

f. Migratory landbirds. The elk hunt would occur within the majority of the Refuge's palustrine scrub-shrub willow habitat (primarily the Rays Lake area) which provides important habitat for migratory landbirds. While elk hunting would have negative (disturbance) effects upon fall migratory landbirds within these habitats, the overall impacts are expected to be minor. Periodic shooting, or hunters walking through willow riparian habitat, could temporarily disperse birds. This disturbance would be limited in scope by the low number of elk hunters at any given time (maximum of 2 daily). The rate of gunfire discharge is expected to be infrequent and random based upon opportunistic individual shots at elk in range. The frequency of gunfire may be only a few shots per day at most, causing temporary and short term disturbance to landbirds. Conversely, the elk hunt potentially could cause minor to moderate positive effects to willow riparian and scrub-shrub habitat through reduced browsing pressure, resulting in benefits to migratory landbirds.

B. Public Use Conflicts

Camas NWR is open year-round and provides a variety of recreational opportunities for an estimated six to seven thousand annual visitors. The Refuge currently offers a mix of wildlife-dependent uses (wildlife observation, photography, hunting, interpretation and education), and non-wildlife dependent uses (hiking, biking, snowshoeing, and cross-country skiing). Under the Preferred Alternative of the Draft CCP, the above activities would be restricted to roads and designated trails, to minimize disturbance to wildlife. Refuge visitation is highest during the spring waterfowl migration, in particular when good numbers of snow geese are roosting on the Refuge wetlands. The next peak in visitation occurs during the white-tailed deer rut, when the Refuge is a popular destination for wildlife photographers.

The Refuge offers a 6.3 mile self-guided auto-tour route that is currently open year round to vehicles, foot and bicycle traffic and would continue to be open to these uses in the Preferred Alternative. Most public use currently occurs on the auto-tour route, and on the 0.5 mile birding trail and observation deck, all of which are within the no-hunting area. There are also 6.5 miles of additional roads that are open seasonally (not maintained during the winter) to vehicle traffic for wildlife observation, photography and to provide access to hunting. Under the Preferred Alternative, hiking, biking, jogging, cross-country skiing or snowshoeing would be allowed on approximately 27 miles of un-maintained and un-groomed Refuge service roads, year round; off road hiking would be prohibited. The portions of these roads within the elk hunt area would remain open to non-hunting uses during the hunt season. In addition, photographers would be allowed to place portable blinds within 100 feet of roads, with a maximum of 5 blinds being allowed on the Refuge at a given time. All access points to hunt areas will be clearly signed to advise visitors that they are entering the area at their own risk. This signage would likely discourage some non-hunters from entering hunt areas. Hunt areas and seasons would be clearly indicated in Refuge brochures and maps. Existing State regulations that prohibit discharge of firearms from or across public right of ways would minimize risk of trajectories into the non-hunting portion of the Refuge.

By limiting the number of elk hunters on the Refuge to two (2) at any given time (with a maximum of 20 big game hunting permits issued annually) and requiring a pre-hunt orientation where safety will be stressed, conflicts with non-consumptive users should be minimal and only result in a minor negative effect to recreational wildlife observation and photography opportunities.

While the general assumption is that elk hunting may have a minor negative effect on Refuge wildlife observation and photography opportunities, it is also possible that wildlife observation and photography opportunities could be increased as elk move away from the hunted zones toward no hunting zones. However, it is also possible that hunters could move elk off the Refuge entirely, decreasing opportunities to observe and photograph elk during the hunt season. Due to uncertainties in the response of wildlife to Refuge hunting disturbance, the Refuge has developed strategies to work with Idaho Department of Fish and Game to re-assess the effectiveness of the elk hunt every five years and re-evaluate the hunt related to both consumptive and non-consumptive recreational objectives for the Refuge.

Refuge personnel will meet in January to evaluate the safety and quality aspects of this hunt and make adjustments to number of hunters and area closures if necessary to ensure a safe, quality hunt that minimizes impacts to sensitive non-target wildlife resources. If Refuge closures do occur, the general public will be notified of closure dates via press releases to local media, and the Refuge Web site.

The Refuge Manager will meet with the regional IDFG staff annually in May to review the effectiveness of the previous season’s hunt and discuss the number of permits, special closures for critical resources, and other related resource concerns for the upcoming season.

C. Refuge Management Conflicts

Existing staff (management, biological, law enforcement, maintenance) and funding would cover approximately 50% of the initial cost of initiating the proposed elk hunting program, and 80% of estimated annual costs. Additional funding would be sought to implement the elk hunting program. Existing staff and funding are sufficient to administer the migratory game bird and upland game bird hunting programs. Gradual implementation of the elk hunting program, with no more than 10 permits being issued during the first year of the program, will allow the Refuge to evaluate quality and safety aspects of the program and make adjustments as needed. A pre hunt evaluation will be conducted annually with IDFG, in May, to ensure the hunts are meeting the objectives of both agencies with minimal disruption to Refuge operations.

The proposed elk hunt has the potential to conflict with other management activities that routinely occur during the hunting season. Safety briefings for staff working on projects such as research, inventory and monitoring of habitats, fencing, road maintenance, signage, etc. in hunt areas will keep staff aware of hunting times and locations. During the work week hunters will be warned of Refuge activities and Refuge staff will wear hunter orange while they are engaged in work activities that may be occurring in the hunt units. These measures should ensure that there will be no administrative conflicts.

VII. CONDUCT OF THE HUNTING PROGRAM

A brochure with a map and explanation of Refuge specific regulations will be developed for the Camas NWR elk, migratory game bird, and upland game bird hunts. National Wildlife Refuge hunting program regulations can be found in 50 CFR 32.3. Special Regulations specific to Camas NWR will be posted in the Code of Federal Regulations (50 CFR). Hunters should be familiar with CFR and regulations as listed in the Big Game, Upland Bird and Waterfowl Regulations pamphlets distributed by IDFG.

1. Regulations Common to All Species

- Each hunter will secure and possess the required State and Federal licenses, tags, stamps or permits.
- Each hunter will comply with the applicable provisions of all State and Federal laws as well as hunting regulations of the State of Idaho.
- Hunters may enter the Refuge 1 hour before shooting time and must leave within 1 hour after shooting time ceases.
- Only those firearms identified for that specific hunting season are allowed.
- It is unlawful to shoot from or across the traveled portion, shoulders, or embankments of any road maintained by any government entity.
- Motorized vehicles will be limited to designated parking areas, with access walk-in from parking lots, except as may be permitted on open roads to remove harvested elk.
- Camping, overnight use, and fires are prohibited.
- No ATVs are allowed on the Refuge.
- No overnight parking is allowed.
- No trapping is allowed.
- It is unlawful to use or possess alcoholic beverages or drugs while on Camas National Wildlife Refuge.
- Individuals may possess, carry and transport, concealed, loaded and operable firearms on the Refuge in accordance with all provisions of state and local law.
- Persons may only use (discharge) firearms in accordance with Refuge regulations (50 CFR 27.42 and specific Refuge regulations in 50 CFR 32).
- Target shooting and sighting-in weapons are not permitted.
- Unless declared as open, all other forms of hunting are prohibited.
- Unless a valid permit (migratory or upland game bird hunting license or big game access permit) allows legal entry on to the Refuge for that season, retrieval of the animal is prohibited.

2. Big Game Regulations Specific to Camas NWR

- State of Idaho hunting license, GMU 63 elk tag, and Refuge access permit are required.
- Elk hunting access permit information and applications for the drawing will be available at Camas NWR office. Elk hunting access permit applications must be

submitted by the second Friday in July of each year. The draw for permits will occur on the following Monday. Selections will be made by a random draw.

- Refuge access permits for elk hunting allow access on Fridays, Saturdays, Sundays, Mondays and Tuesdays within an assigned two-week period, until an elk is harvested. Upon receiving the permit, the permittee must contact the Refuge to set up a hunt date at least seven days before the hunter's arrival. Hunt dates will be reserved on a first come, first serve basis with priority going to disabled, mobility impaired hunters and youth hunters (hunters aged 12-17). Permits may not be transferred.
- Before each hunt, Refuge staff or a trained Refuge volunteer will provide an orientation describing the hunt procedures, description of hunt area, an overview of special Refuge regulations, safety reminders, description of non-target wildlife and a check of licenses/permits.
- Elk hunters may enter Refuge 1 hour before shooting time begins and must leave within 1 hour after shooting time ceases, unless retrieving an elk.
- Refuge elk hunting hours will coincide with the state hunting hours for big game, currently ½ hour before sunrise to ½ hour after sunset.
- No dogs are allowed for elk hunting activities.
- Shooting into any Closed Area is prohibited.
- Hunters (or designated assistants of mobility impaired hunters) must be accompanied by Refuge staff or trained volunteer when entering areas of the Refuge that are closed to hunting in order to retrieve elk.
- Elk hunters may only use a shoulder fired weapon, using only center fire cartridges larger than 20 caliber.
- All persons participating in the hunt must wear a minimum of 500 square inches of fluorescent orange material above the waistline, which is visible, from all directions. A vest and hat normally meet this requirement, a hat alone does not.

3. Youth Elk Hunt Regulations Specific to Camas NWR

- Participants in the youth hunt must be accompanied by, and in the immediate presence of a non-hunting adult.
- Applicants must be at least 12 years of age but not 18 years of age at the time of the hunt application.

4. Mobility Impaired Elk Hunt Regulations Specific to Camas NWR

- State of Idaho disabled combination hunting license, GMU 63 elk tag, and Refuge mobility impaired access permit is required.
- To receive a Refuge mobility impaired access permit, hunters meet at least one of the following Refuge-specific criteria: 1) Mobility impairment resulting from permanent medical conditions which makes it physically impossible for them to hunt without the assistance of an attendant; 2) Need a medically prescribed assistive device for mobility; or 3) be at least 65 percent disabled.

- Mobility impaired hunters may be accompanied by a non-hunting assistant, designated in writing in accordance with State regulations.
- Mobility impaired hunters may use portable blinds. Hunting from vehicles is prohibited.

5. Migratory Game Bird Regulations Specific to Camas NWR

- Waterfowl hunting is allowed only in the two designated migratory and upland game bird hunt units.
- Only ducks, geese, coots, mergansers, and snipe may be hunted. Dates, hunting hours and bag limits for these species correspond to State regulations.
- Migratory Game Bird hunters may enter the Refuge 1 hour before shooting time and leave within 1 hour after shooting time ceases.
- Temporary blinds of natural vegetation may be constructed, but such blinds shall be available for general use on a first-come, first-served basis.
- Construction of permanent blinds is prohibited.
- All personal property including decoys must be removed from the Refuge at the end of each day.
- Nontoxic shot is required for all waterfowl and upland game bird hunting and must be 0.20 inches in diameter (T size) or smaller.
- Use of retriever and flushing dogs is allowed. Dogs must be under control of their owners at all times.
- Hunters must pick up spent shotgun shells and all other trash.

6. Upland Game Bird Regulations Specific to Camas NWR

- Upland game bird hunting is allowed only on the two designated waterfowl and upland game hunt units.
- Only ring-necked pheasant, gray partridge, and sage-grouse may be hunted. Dates, hunting hours and bag limits for these species correspond to State regulations.
- Upland Game Bird hunters may enter Refuge 1 hour before shooting time and leave within 1 hour after shooting time.
- Firearms used in upland game bird hunting are restricted to the use of shotguns only.
- Use of retriever and flushing dogs is allowed. Dogs must be under control of their owners at all times.
- Hunters must pick up spent shotgun shells and all other trash.
- Nontoxic shot is required for all waterfowl and upland game bird hunting and must be 0.20 inches in diameter (T size) or smaller.

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Ruddy duck male. Farrel Downs/USFWS

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National Wildlife Refuge System Information
1 800/344 WILD

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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.

Front Cover Photo:
Snow geese in an open field on the refuge. USFWS

Inset photos:
Yellow-headed blackbird. ©Donn Larsen
Cotton-tailed rabbit. ©Donn Larsen
Bull elk in sage. ©Donn Larsen