

Appendix A. Environmental Assessment

Sacramento, Delevan, Colusa, and Sutter National Wildlife Refuges

Environmental Assessment

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Chapter 1. Purpose of and Need for Action

Introduction

This environmental assessment (EA) evaluates the environmental effects of four alternatives for managing the Sacramento, Delevan, Colusa, and Sutter National Wildlife Refuges (Refuges). This EA will be used by the U.S. Fish and Wildlife Service (Service or USFWS) to solicit public involvement in the refuge planning process and to determine whether the implementation of the Comprehensive Conservation Plan (CCP) would have a significant effect on the quality of the human environment. This EA is part of the Service's decision-making process in accordance with the National Environmental Policy Act (NEPA) (42 U.S.C. 4321-4347), as amended, and its implementing regulations.

Proposed Action

The Service proposes to develop and implement a CCP for the Sacramento, Delevan, Colusa, and Sutter Refuges that best achieves the purposes for which the Refuges were established, helps fulfill the mission of the National Wildlife Refuge System (Refuge System), is consistent with sound fish and wildlife management, and ensures that the biological integrity, diversity, and environmental health of the Refuge System are maintained.

The Service examined a range of management alternatives. Specific details regarding the preferred alternative and the other alternatives that were evaluated are provided in Chapter 2. Of these, Alternative C represents the Service's proposed action for the Sacramento, Delevan, Colusa, and Sutter Refuges. However, the final decision can be any of the alternatives, and may reflect a modification of certain elements of any alternative based on consideration of public comment. This alternative is described in more detail in Chapter 4 of the CCP. Of the alternatives evaluated, this alternative appears to best achieve the purpose, vision, and goals for the Refuges, while also appropriately addressing the major issues and relevant mandates identified for each Refuge during the CCP process.

Purpose of and Need for the Proposed Action

The development of a CCP provides guidance for conducting general refuge operations, wildlife and habitat management, habitat enhancement and restoration, and visitor services. The CCP is intended to ensure that management actions are consistent with the purposes for which the Refuges' were established, the mandates of the Refuge System, and the Refuges' goals and objectives. The purpose of this CCP is to describe the desired future conditions of the Sacramento, Delevan, Colusa, and Sutter Refuges over the next 15 years and provide guidance for achieving those conditions. This CCP:

- Sets a long term vision for the Refuges;
- Establishes management goals, objectives, and strategies for the Refuges;
- Provides the Refuges with a 15-year management plan for the conservation of fish, wildlife, and plant resources and their related habitats;
- Defines compatible public uses;
- Develops a plan that, when fully implemented, will achieve Refuge purposes, help fulfill the mission of the System, and maintain and, where appropriate, restore ecological integrity;
- Communicates the Service's management priorities for the Refuges to the public; and

- Provides a basis for budget needs to support staffing, operations, maintenance, and capital improvements.

The development of this CCP is also required to fulfill legislative and contractual obligations of the Service. The National Wildlife Refuge System Administration Act of 1966, as amended by the National Wildlife Refuge System Improvement Act of 1997 (Improvement Act), requires that every refuge or related complex of refuges have a CCP in place within 15 years of the Improvement Act's enactment. The NEPA requires that an EA or Environmental Impact Statement (EIS) be prepared to accompany the CCP to evaluate the effects of different alternatives which meet the goals of the Refuges and identifies the Service's proposed action for implementing the CCP.

Project Area

The Sacramento, Delevan, Colusa, and Sutter Refuges are part of the Sacramento National Wildlife Refuge Complex (Complex) and are located in the Sacramento Valley of north-central California. The Valley is bordered on the east by the Sierra Nevada Range and on the west by the Coast Range. More detailed information about the project area can be found in Chapter 3 of the CCP.

Sacramento National Wildlife Refuge

Sacramento Refuge was established in 1937 to provide refuge and breeding habitat for migratory birds and other wildlife, and it functions as the headquarters for the entire Complex. The Refuge is currently 10,819 acres (Figure 1 of the CCP) and is comprised of approximately 7,086 acres of managed wetlands (summer wetlands and seasonally flooded wetlands); and 3,360 acres of unmanaged wetlands, grasslands, alkali meadows, vernal pools, and riparian habitats. While most of these habitats no longer reflect what once existed on the land, management programs do attempt to mimic a natural landscape that once occurred throughout the Sacramento Valley on a much grander scale.

California's wetland habitat loss (90 to 95 percent of the wetlands in the Central Valley), a regulated water supply and the State's ever-increasing human population and its associated impacts have resulted in increasing dependence by wintering waterfowl on these artificially created and maintained habitats. As a result, the Service must now intensively manage the Refuge in order to provide a consistent quantity and quality of habitats to compensate for habitat losses due to agricultural and urban development. Those species that benefit include those that are rare and abundant, resident and migratory, game and non-game.

The Refuge currently supports approximately 250 species of birds. By far, the most dramatic are the wintering concentrations (November to January) of 500,000 to 750,000 ducks and 200,000 geese. Historically, this is quite a change, as the area formerly supported many more geese than ducks, but the advent of rice culture in the early 1900s helped shift the balance. Raptor numbers swell as the waterfowl numbers increase, with their ranks including bald eagles and peregrine falcons. In addition, shorebird populations peak in the spring, while some waterfowl and numerous migratory songbird species nest here during the summer.

The Refuge is also home to numerous rare, threatened or endangered species, of which eight (many associated with vernal pools) are federally listed. The alkali meadow and vernal pool habitats on the Refuge represent some of the largest remaining areas of this habitat type.

The visitor center is located in the Refuge headquarters office. Refuge staff is available to help plan a visit, answer questions and assist visitors. There are a number of opportunities to enjoy including a wildlife diorama, discovery room, and bookstore. Recreation activities on the Refuge include hunting, wildlife observation, photography, environmental education, and interpretation. A six-mile auto tour route with an interpretive radio broadcast and a two-mile walking trail are open year-round. A multi-level viewing platform on the auto tour gives a panoramic view of the Sacramento Valley and provides visitors with opportunities to observe wildlife from among the treetops. Two photography blinds are available by advance reservation. Hunting of waterfowl, coot, common moorhen, snipe, and pheasant is permitted on the southern portion of the Refuge on Saturdays, Sundays, and Wednesdays during the legal seasons. The hunt program is cooperatively managed with the California Department of Fish and Game (CDFG) and offers spaced blind, assigned pond, and free roam hunting opportunities via a permit system.

Delevan National Wildlife Refuge

Delevan Refuge was established in 1962 to provide sanctuary for migratory birds. The Refuge consists of 5,877 acres (including the 80-acre Rennick property) (Figure 1 of the CCP) and is comprised of approximately 4,600 acres of managed wetlands (summer wetlands and seasonally flooded wetlands) and approximately 984 acres of unmanaged wetlands, grasslands, alkali meadows, vernal pools, and riparian habitats. The endemic plant species, palmate-bracted bird's beak, located in the alkali meadows, is of particular interest. Delevan Refuge (with an average annual population of 150,000 to 200,000 plants) is home to the largest remaining population of this plant, which is considered endangered on both Federal and State lists.

Waterfowl populations peak at nearly 415,000 ducks and over 150,000 geese. Of special importance is the tule white-fronted goose, as a significant portion of the Pacific Flyway's relatively small population utilizes this Refuge during the fall and winter months. The Refuge also supports significant breeding colonies of tricolored blackbirds.

Visitor service activities include wildlife observation and photography from perimeter roads. Hunting of waterfowl, coot, common moorhen, snipe, and pheasant is permitted on the southern portion of the Refuge on Saturdays, Sundays, and Wednesdays during the legal seasons. The cooperatively managed hunt program with the CDFG offers spaced hunt site, assigned pond, and free roam hunting opportunities via a permit system.

Colusa National Wildlife Refuge

Colusa Refuge was established in 1945 to provide sanctuary for migratory birds and alleviate crop depredation. It consists of over 4,686 acres (including the 646 acres acquired via North Central Valley Wildlife Management Area) (Figure 1 of the CCP). It is comprised of approximately 3,347 acres of managed wetlands (summer wetlands and seasonally flooded wetlands) and approximately 1,191 acres of unmanaged wetlands, grasslands, alkali meadows, vernal pools, and riparian habitats. The Refuge lies in the Colusa Basin and is bisected by the Colusa Basin Drain, which drains the Basin southeast to the Sacramento River. The low topography and presence of the Colusa Basin Drain makes Refuge lands subject to regular winter flooding.

Currently, peak waterfowl populations can exceed 200,000 ducks and over 75,000 geese. In addition, significant populations of giant garter snakes (Federal-listed threatened species) and palmate-bracted bird's beak occur on the Refuge, as does the second largest acreage of vernal pools on the Complex.

Visitor service activities include wildlife observation and photography on a three-mile self-guided auto tour, and/or on a one-mile walking trail along a riparian slough and wetland. The auto tour and walking trail are open sunrise to sunset, year-round, with interpretive panels and pamphlets available at a kiosk. A photography blind is available by advanced reservation. Hunting of waterfowl, coot, common moorhen, snipe, and pheasant is permitted on the southern portion of the Refuge on Saturdays, Sundays, and Wednesdays during the legal seasons. The cooperatively managed hunt program with the CDFG offers both assigned pond and free roam hunting opportunities via a permit system.

Sutter National Wildlife Refuge

Sutter Refuge was established in 1945 to provide sanctuary for migratory birds and to alleviate crop depredation. Sutter Refuge is located in the Sutter Basin between the Sacramento and Feather Rivers (Figure 1 of the CCP). Historically, these rivers and Butte Creek flooded the Sutter Basin during the winter and spring. In the 1920s, the Sutter Bypass levees were constructed to channel these floodwaters. Over 80 percent of the Refuge lies within the northern portion of the Bypass and gradually slopes to the south. When floodwaters flow in the Bypass, the Refuge can be under at least 10 feet of water.

Sutter Refuge has 2,591 total acres, of which over 2,000 (approximately 80 percent) are located inside the Bypass. Habitat types, both inside and outside the Bypass, consist of approximately 1,881 acres of seasonal and summer wetlands and approximately 674 acres of unmanaged wetlands, grasslands, and riparian habitats.

Waterfowl populations peak later than most other Refuges in the Complex (January to February) and include nearly 200,000 ducks and 50,000 to 100,000 geese. In addition, due to its border canals and associated riparian habitat, Sutter Refuge has one of the highest frequencies of yellow-billed cuckoos (Federal candidate species) on the Complex.

Visitor service activities on the Refuge are limited to hunting of waterfowl, coot, common moorhen, snipe, and pheasant on the southern portion of the Refuge on Saturdays, Sundays, and Wednesdays during the legal seasons. The cooperatively managed hunt program with the CDFG consists of free roam hunting opportunities via a permit system.

Decisions to be Made

Based on the analysis documented in this Draft EA, the Regional Director must determine the type and extent of management and public uses on the Refuges and whether the selected management alternative would have a significant effect on the quality of the environment. If the selected alternative has significant impacts, the Service is required to prepare an EIS. If the selected alternative has no significant impacts a Finding of No Significant Impact (FONSI) is prepared.

The planning team has recommended Alternative C to the Regional Director. The accompanying Draft CCP was developed for implementation based on this recommendation.

Issue Identification

Issues, concerns, and opportunities were identified through early planning discussions and the public scoping process, which began with publishing the Notice of Intent (NOI) in the Federal Register and mailing of the first planning update in July 2005. Other comments were received in

writing and noted through personal communications with refuge staff. For a more in depth description of the issues, see Chapter 2 of the CCP. Public scoping and involvement helped direct this process and provided important elements in the synthesis of the goals, objectives, and strategies found in the CCP for the proposed action and in this document for all other alternatives.

Issues discussed under each alternative include habitat management, migratory birds, threatened and endangered species, and visitor services. Additional issues are addressed for each alternative in Table 1.

Public Involvement

The Service initiated the planning process by publishing the NOI in the Federal Register on July 18, 2005. Planning updates were sent to a mailing list of over 450 individuals, groups, and agencies in July 2005, April 2006, and June 2008. Public scoping meetings were held in July of 2005 in Willows, Colusa, and Yuba City, California.

Public input received in response to these updates and public meetings is incorporated into the CCP and EA, and a summary of comments is included in Chapter 2 of the CCP. The original comments are being maintained in planning team files at the Complex Headquarters in Willows, California, and are available for review. Chapter 5 of this EA contains a list of individuals and organizations that were notified or were sent a copy of the Draft CCP, were sent planning updates, or attended scoping meetings.

Related Actions

Please see Chapter 1 of the CCP for a description of related actions, projects, and studies in the area.

U.S. Fish and Wildlife Service and National Wildlife Refuge System

The mission of the Service is to conserve, protect, and enhance the nation's fish and wildlife and their habitats for the continuing benefit of the American people. The Service is the primary Federal agency responsible for migratory birds, endangered plants and animals, certain marine mammals, and anadromous fish. The responsibility to conserve our nation's fish and wildlife resources is shared with other Federal agencies and State and Tribal governments.

As part of this responsibility, the Service manages the National Wildlife Refuge System (Refuge System). The Refuge System is the only nationwide system of Federal lands managed and protected for wildlife and their habitats. 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.

The Refuges are managed as part of the Refuge System in accordance with the National Wildlife Refuge System Administration Act of 1966 as amended by the National Wildlife Refuge System Improvement Act of 1997, and other relevant legislation, Executive Orders, regulations, and policies. Chapter 1 of the CCP also provides more information about the Service and the Refuge System. Appendix M of the CCP summarizes these major laws, regulations, and policies.

Refuge Purposes

The Service acquires Refuge System lands under a variety of legislative acts and administrative orders. The official purpose or purposes for 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. The Service defines the purpose of a refuge when it is established, or when new land is added to an existing refuge. These purposes, along with the Refuge System mission, are the driving force in developing refuge vision statements, goals, objectives and strategies in the CCP. The purposes also form the standard for determining if proposed refuge uses are compatible.

Sacramento Refuge Purposes

“... as a refuge and breeding ground for migratory birds and other wildlife...” Executive Order 7562, February. 27, 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 of 1929)

“... to conserve (A) fish or wildlife which are listed as endangered species or threatened species or (B) plants ...” 16 U.S.C. § 1534 (Endangered Species Act of 1973)

“... suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ...” 16 U.S.C. 460k-1 “... the Secretary ... may accept and use ... real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors ...” 16 U.S.C. 460k-2 (Refuge Recreation Act of 1962 (16 U.S.C. 460k-460k-4), as amended).

“... for the development, advancement, management, conservation, and protection of fish and wildlife resources ...” 16 U.S.C. 742f(a)(4) “... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ...” 16 U.S.C. 742f(b)(1) (Fish and Wildlife Act of 1956)

Delevan Refuge Purpose

“... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” 16 U.S.C. 715d (Migratory Bird Conservation Act of 1929)

Colusa Refuge Purposes

“... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” 16 U.S.C. 715d (Migratory Bird Conservation Act of 1929)

“... for the management and control of migratory waterfowl and other wildlife ...” 16 U.S.C. 695 (Lea Act of 1948)

“... to conserve (A) fish or wildlife which are listed as endangered species or threatened species or (B) plants ...” 16 U.S.C. 1534 (Endangered Species Act of 1973)

Sutter Refuge Purposes

“... for use as an inviolate sanctuary, or for any other management purpose, for migratory birds.” 16 U.S.C. 715d (Migratory Bird Conservation Act of 1929)

“... for the management and control of migratory waterfowl and other wildlife ...” 16 U.S.C. 695 (Lea Act of 1948)

“... suitable for (1) incidental fish and wildlife-oriented recreational development, (2) the protection of natural resources, (3) the conservation of endangered species or threatened species ...” 16 U.S.C. 460k-1 “... the Secretary ... may accept and use ... real ... property. Such acceptance may be accomplished under the terms and conditions of restrictive covenants imposed by donors ...” 16 U.S.C. 460k-2 (Refuge Recreation Act of 1962 (16 U.S.C. 460k-460k-4), as amended)

“... for the development, advancement, management, conservation, and protection of fish and wildlife resources ...” 16 U.S.C. 742f(a)(4) “... for the benefit of the United States Fish and Wildlife Service, in performing its activities and services. Such acceptance may be subject to the terms of any restrictive or affirmative covenant, or condition of servitude ...” 16 U.S.C. 742f(b)(1) (Fish and Wildlife Act of 1956)

The Refuge Vision Statement

A vision statement is developed for each refuge or complex as part of the CCP process. Vision statements are grounded in the unifying mission of the Refuge System; they describe the desired future conditions of the refuge unit in the long term (more than 15 years), based on the refuge’s specific purposes, the resources present on the refuge, and any other relevant mandates. This CCP incorporates the following vision statement for the Sacramento, Delevan, Colusa, and Sutter Refuges.

“Located in the Sacramento Valley of California, Sacramento, Delevan, Colusa, and Sutter National Wildlife Refuges are some of the most important wintering areas for waterfowl along the Pacific Flyway and in North America. The Refuges’ wetland, vernal pool, alkali meadow, grassland, and riparian communities will provide high-quality habitat for a diverse array of wildlife species, including migratory waterfowl, shorebirds, birds of prey, and songbirds. These habitats will also provide food, water, and cover for threatened and endangered species, including vernal pool plants and invertebrates, and giant garter snakes.

Working with partners, the Refuges will provide a wide range of environmental education programs and promote high quality wildlife-dependent recreation in order to maintain a refuge support base and attract new visitors. Compatible wildlife-dependent recreational opportunities for hunting, wildlife observation, photography, environmental education, and interpretation will be provided on the Refuges.”

Refuge Goals

This section contains the primary goals that will define the management direction of the Refuges for the next 15 years. In addition, as part of the CCP, refuges are expected to develop objectives and strategies that together, will help achieve the goals. *Goals* are broad statements of the desired future conditions for refuge resources. Refuge goals may or may not be feasible within the 15-year

time frame of the CCP. Whenever possible, *objectives* are quantified statements of a standard to be achieved or work to be accomplished. They should be specific, measurable, achievable, results-oriented, and time-fixed, and should be feasible within the 15-year lifespan of the CCP. *Strategies* are specific actions, tools, or techniques that contribute toward accomplishing the objective. In some cases, strategies describe specific projects in enough detail to assess funding and staffing needs.

The five goals of the Sacramento, Delevan, Colusa, and Sutter National Wildlife Refuges are outlined below to provide a context for the proposed management direction.

Goal 1: Wildlife and Habitat Goal

Conserve, manage, restore, and enhance habitats and associated plant and wildlife species, with an emphasis on supporting an abundance and natural diversity of wintering and migrating waterfowl, shorebirds, birds of prey, and songbirds.

Goal 2: Threatened and Endangered Species Goal

Conserve, manage, restore, and enhance threatened and endangered species and their habitats, including vernal pool plants and invertebrates, and giant garter snakes.

Goal 3: Visitor Services Goal

Provide visitors of all ages and abilities with quality wildlife-dependent recreation (hunting, wildlife observation, photography, environmental education, and interpretation), and volunteer opportunities to enhance public appreciation, understanding, and enjoyment of fish, wildlife, habitats, and cultural resources.

Goal 4: Partnership Goal

Promote partnerships to preserve, restore, and enhance a diverse, healthy, and productive ecosystem in which the Refuges play a key role.

Goal 5: Resource Protection Goal

Adequately protect and maintain all natural and cultural resources, staff and visitors, equipment, facilities, and other property on the Refuges.

Chapter 2. Alternatives, Including the Proposed Action

Introduction

This chapter describes the process used to develop alternatives, similarities among the alternatives, a detailed description of each alternative, and a summary comparison of the alternatives. All alternatives considered in this EA were developed with the mission of the Refuge System and the purposes of the Refuges as guiding principles. The Service's preferred alternative is Alternative C. Three of the four alternatives presented in this chapter are "action alternatives" that would involve a change in the current management of the Refuges. The remaining alternative is the No Action alternative, in which the Service would continue managing the Refuges as it currently does. The four alternatives for managing the Sacramento, Delevan, Colusa, and Sutter Refuges include: Alternative A, Current Management (No Action); Alternative B, Emphasize Biological Resources Alternative; Alternative C, Preferred Alternative; and Alternative D, Emphasize Visitor Services Alternative. These alternatives are summarized in Table 1 and are described below.

Current Management

The Refuges are managed to preserve, restore, and enhance habitat for breeding and wintering migratory birds, threatened and endangered species, resident species, and native plants. The Refuges also provide wildlife-dependent recreation, including hunting, wildlife observation, photography, environmental education, and interpretation. Chapter 3 of the CCP describes the Refuges' current management practices and visitor services in detail.

Alternatives Development Process

NEPA requires Federal agencies to evaluate a full range of reasonable alternatives, including a preferred alternative. The alternatives should meet the purpose and need of the proposal while minimizing or avoiding detrimental effects. The NEPA alternative development process allows the Service to work with the public, stakeholders, interested agencies, and Tribes to formulate alternatives that respond to identified issues.

After developing the Refuges' vision statement and goals, the planning team reviewed and evaluated the scoping comments received in response to the NOI, as well as the comments provided at a series of public meetings held to discuss management activities and visitor services on the Refuges. A list of major issues related to the management of the Refuges was developed using this input, along with additional input from the planning team and other Service staff (refer to Chapter 2 of the CCP).

Once the list of important management issues was generated, the planning team described the No Action Alternative. It was important to describe this alternative accurately because the No Action Alternative serves as the baseline to which all other alternatives are compared.

Each alternative describes a combination of habitat and visitor service prescriptions designed to achieve the Refuges' purposes, vision, and goals. These alternatives provide different ways to address and respond to public issues, management concerns, and opportunities identified during the planning process. All of the issues, activities, and management concerns were evaluated and

addressed for each alternative.

Features Common to All Alternatives

Although there are distinct differences among the range of alternatives developed for the Sacramento, Delevan, Colusa, and Sutter Refuges, a number of management components are common to all and would be part of the CCP regardless of the alternative selected for implementation.

To reduce repetition in the alternative descriptions, those features that are common among all of the alternatives are described in detail below.

Habitat Management – Intensively managed wetlands comprise the majority of the Refuges 270 habitat management units. Refuge management is determined, guided, and tracked by a process to develop annual Habitat Management Plans (HMP). The primary wetland habitat types for which management occurs are: seasonally flooded wetlands and summer wetlands. Vegetation management is relatively common on the Refuges, and is generally used to control the abundance of certain plant species or their distribution and to enhance desirable species. Prescribed fire is used to accomplish habitat and Wildland Urban Interface (WUI) objectives. The Refuges also implement the Integrated Pest Management (IPM) process.

Water Management – Refuge wetlands are created and maintained using water delivered through local irrigation districts to human-made impoundments. They are flooded up and drawn-down with nearly complete control through inlet and outlet water control structures. Flooding regimes are designed to mimic historic wetland availability as closely as possible, given water availability and considering statewide wetland losses. Furthermore, the timing of drawdowns, irrigations, and floodups largely dictates plant species composition (i.e. germination and growth of desirable food and cover plants). It also governs habitat availability (i.e. how much wetland is flooded at certain times of the year for certain wildlife species). A permanent water supply would be secured for Sutter Refuge, Central Valley Project Improvement Act (CVPIA) water allotments would be redistributed among Refuges, and groundwater or other outside sources of water would be developed to meet habitat management needs.

Biological Monitoring - Monitoring and research are the foundation for Refuge management decisions. At the Refuge level, biological data collected during wildlife and habitat surveys are used to help document the relative distribution and abundance of biological resources at the Refuge and Complex level. Focused research studies are sometimes required to provide additional data that cannot be obtained from regular Refuge surveys. All the information is used to prioritize where management efforts are most needed.

Migratory Bird Management – One of the Refuges' primary purposes is to provide habitat for migratory birds, particularly wintering waterfowl. The Refuges coordinate and/or participate in a number of migratory bird surveys and monitoring projects throughout the year. Depending on the survey, these efforts are used for monitoring migratory birds at the Refuge, Valley, State, Pacific Flyway, or national level. They include aerial and ground migratory bird surveys, evaluation of annual arctic goose productivity (age ratios), waterfowl marking, breeding bird surveys, and a number of other special surveys conducted for species of concern.

Monitoring of Listed Species – The Refuges provide habitat for a number of threatened, endangered, and sensitive species. A number of surveys are conducted to monitor listed vernal pool/alkali meadow species, and giant garter snakes on the Refuges. Depending on species, these include bi-weekly regular wildlife surveys, annual surveys, or surveys on an opportunistic basis. Periodic research efforts also help monitor population demographics, distribution, and effects of current or proposed habitat management treatments.

Invasive/Pest Species Control – It is necessary to control certain plant and animal species that have undesirable effects on Refuges' plants and habitats or pose a public health risk. The Refuges actively control or permit control of a number of invasive and/or exotic plants, and disease vectors using the IPM process. Periodic control of invasive plant species is implemented to enhance the quality of the native habitats on the Refuges.

Disease Monitoring – Wildlife disease monitoring is conducted opportunistically during site visits, field inspections, and wildlife surveys. Follow-up treatment includes carcass removal, documentation of site and carcass conditions, and either carcass disposal or shipment to the U.S. Geological Survey National Wildlife Health Center, where carcasses are tested to determine the cause of death. The refuge staff monitors wetlands and track any mortality that may indicate a disease outbreak.

Mosquito Management - The Refuges strive to responsibly address risks to public health and safety and protect trust resources from mosquito-borne diseases and the impacts of mosquito pesticides on wildlife and the ecosystem. The refuge staff works cooperatively with the local Mosquito and Vector Control districts (Districts) in the management of mosquito populations on the Refuges.

Facilitation of Appropriate Scientific Research – Research projects are often conducted in cooperation with other government agencies, universities, or private conservation organizations. The Refuges are often a component of much larger projects that may include the entire Pacific Flyway, or the known range of a species. This level of monitoring or research helps define the Refuges' role and importance in the conservation of certain species or habitat and also factors into management decisions.

Protection of Cultural Resources - Though few systematic archaeological surveys have been conducted, several prehistoric and historic cultural resources have been documented, including one historic district that has been determined eligible for listing in the National Register of Historic Places. All cultural resource site locations are kept confidential and are monitored on a regular basis. Cultural resources are managed in accordance with public law and agency policy. The refuge manager would continue to consider the effects of the preferred alternative on the Refuges' archaeological and historic properties and would consult with the State Historic Preservation Office (SHPO), federally recognized Tribes, and interested parties, when appropriate, prior to implementing any ground disturbing projects or projects effecting historic structures.

Fire Management – Prescribed fire is an integral part of habitat management on the Complex. Prescribed fires are used on the Refuges to reduce hazard fuels, restore the natural processes and vitality of ecosystems, improve wildlife habitat, remove or reduce non-native species, and/or conduct research. Preventing the spread of wildland fire to/or from adjacent properties provides

for the safety of the general public and protection of private and public lands. The Refuges will continue working closely with neighboring communities with the WUI and Rural Fire Assistance (RFA) programs.

Visitor Services – The Refuges provide wildlife-dependent recreation opportunities including hunting, wildlife observation, photography, environmental education, and interpretation. The visitor center is located in the Sacramento Refuge Headquarters office. There are a number of opportunities to enjoy including a wildlife diorama, discovery room, and bookstore. On Sacramento Refuge, a six-mile auto tour route with an interpretive radio broadcast and a two-mile walking trail are open year-round. A multi-level viewing platform on the auto tour route gives a panoramic view of the Sacramento Valley and, from the top platform, provides visitors with opportunities to observe wildlife from among the treetops. On Colusa Refuge, a three-mile self-guided auto tour route and a one-mile walking trail are open year-round. Three photography blinds are available by advance reservation on Sacramento and Colusa Refuges. Hunting of waterfowl, coot, common moorhen, snipe, and pheasant is permitted on the southern portion of each of the Refuges on Saturdays, Sundays, and Wednesdays during the legal seasons.

Law Enforcement and Resource Protection - Law enforcement on the Refuges is used both for protection and prevention. Used for protection, law enforcement safeguards the visiting public, staff, facilities, and natural and cultural resources from criminal action, accidents, vandalism, and negligence. Used as prevention, law enforcement deters incidents from occurring by providing a law enforcement presence.

Facilities Maintenance - General road maintenance, including grading and mowing, is required on the Refuges to provide safe access through the Refuges for staff, researchers, law enforcement activities, and educational field trips. Upland areas require mowing to reduce fire hazards, provide weed suppression, and provide access for maintenance or monitoring projects during the spring and summer months. The Refuges' buildings, visitor parking areas, and trails require frequent maintenance and repair.

Alternatives Considered but Eliminated from Detailed Analysis

The alternatives development process under NEPA and the Improvement Act are designed to allow the planning team to consider the widest possible range of issues and feasible management solutions. These management solutions are then incorporated into one or more alternatives evaluated in the EA process and considered for inclusion in the CCP.

Actions and alternatives that are not feasible or may cause substantial harm to the environment are usually not considered in an EA. Similarly, an action (and therefore, an alternative containing that action) should generally not receive further consideration if:

- It is illegal (unless it is the No Action Alternative, which must be considered to provide a baseline for evaluation of other alternatives, even though it may not be capable of legal implementation);
- It does not fulfill the mission of the National Wildlife Refuge System;
- It does not relate to or help achieve one of the goals of the Refuges; or
- Its environmental impacts have already been evaluated in a previously approved NEPA document.

However, if such actions or alternatives address a controversial issue or an issue on which many public comments were received, they may be considered in detail in a NEPA document to clearly demonstrate why they are not feasible or would cause substantial harm to the environment.

During the alternatives development process, the planning team considered a wide variety of potential actions on the Refuges. The following actions were ultimately rejected and excluded from the alternatives proposed here because they did not achieve Refuges purposes or were incompatible with one or more goals.

Sanctuary Alternative

This alternative would have eliminated all visitor service programs, including hunting, wildlife observation, photography, environmental education, and interpretation on the Refuges. In addition, staff access would be extremely limited to support the concept of a “true” sanctuary. This alternative was not analyzed in detail because it conflicts with the Improvement Act which directs the Service to provide compatible wildlife-dependant recreational opportunities. This mandate would not be met under this alternative. Moreover, this alternative would severely limit the ability to manage habitat for migratory birds on the Refuges which would conflict with the purposes for which the Refuges were established.

Custodial Management Alternative

This alternative would have eliminated all restoration projects, habitat management, and visitor service programs. Refuge management would be limited to maintaining boundary signs and fences. Habitat goals would not have been met and the public would be prevented from accessing the Refuges. This alternative was not analyzed in detail because it conflicts with the Refuge purpose of providing habitat for threatened and endangered species, migratory and resident birds, and other wildlife. The Improvement Act also directs the Service to provide compatible wildlife-dependant recreational opportunities. This mandate would not be met under this alternative.

Hunting Priority Alternative

This alternative would have opened the Refuges as a hunting priority recreational area. Additional areas would have been opened to public hunting, hunting areas and closed zones would have been rotated, and many new facilities would have been built, including hunting access trails, hunting blinds, and parking areas. The Refuges would also have been opened for big game hunting. This alternative was not analyzed in detail because it conflicts with the Refuges’ purpose of providing refuge and habitat for threatened and endangered species, migratory and resident birds, and other wildlife and the stipulated direction of the Improvement Act which puts wildlife first. Conflicts with other wildlife-dependent recreation, also mandated by the Improvement Act, would also occur.

Preferred Alternative

The planning policy that implements the Improvement Act requires the Service to select a preferred alternative which is also the preferred alternative under NEPA. The written description of this preferred alternative is effectively the Planned Management (Chapter 4) of the Draft CCP. Alternative C is the preferred alternative for Sacramento, Delevan, Colusa, and Sutter Refuges because it meets the following criteria:

- Achieves the mission of the National Wildlife Refuge System.
- Achieves the purposes of Sacramento, Delevan, Colusa, and Sutter National Wildlife Refuges.
- Provides guidance for achieving the Refuges' 15-year vision and goals.
- Maintains and restores the habitats and populations on the Refuges.
- Addresses the important issues identified in the scoping process.
- Addresses the legal mandates of the Service and the Refuges.
- Is consistent with the scientific principles of sound fish and wildlife management and endangered species recovery.

The preferred alternative described in the EA is preliminary. The action ultimately selected and described in the Final CCP will be determined, in part, by the comments received on this version of the EA. The preferred alternative presented in the Final CCP may suggest a modification of one of the alternatives presented here.

The four alternatives for managing the Sacramento, Delevan, Colusa, and Sutter Refuges are summarized in Table 1 and are described below.

Table 1. Sacramento, Delevan, Colusa, and Sutter Refuges Alternative/Issue Comparison Summary

Issue	Alternative A No Action Alternative	Alternative B Emphasize Biological Resources Alternative	Alternative C Preferred Alternative	Alternative D Emphasize Visitor Services Alternative
VISITOR SERVICES				
Hunter Selection Process	<ul style="list-style-type: none"> State reservation system for all Refuges Increased reservation draw at Colusa and Sutter NWRs 	<ul style="list-style-type: none"> Access via State reservation only No refills 	Prioritized system on all Refuges <ol style="list-style-type: none"> State reservation Lottery First come first serve 	Same as Alternative C
Type of Waterfowl Hunting	<ul style="list-style-type: none"> Sacramento NWR: spaced blinds, assigned pond, and free roam Delevan NWR: spaced islands, assigned ponds, and free roam Colusa NWR: assigned ponds and free roam Sutter NWR: free roam 	Only spaced hunt areas and assigned ponds on all Refuges	Same as Alternative A except <ul style="list-style-type: none"> Convert a portion of the hunt area to assigned ponds at Sutter NWR Convert some spaced blinds at Sacramento NWR to assigned ponds Convert a portion of the free roam to assigned ponds at Colusa NWR 	Same as Alternative C

Issue	Alternative A No Action Alternative	Alternative B Emphasize Biological Resources Alternative	Alternative C Preferred Alternative	Alternative D Emphasize Visitor Services Alternative
Additional hunting opportunities	<ul style="list-style-type: none"> • Pheasant: waterfowl hunt days in free roam only (all Refuges) and first Monday of season in free roam, assigned ponds, & spaced hunt areas (Sacramento, Delevan, and Colusa NWRs) • Pheasant only hunting units on Sacramento, Colusa, and Sutter NWRs • Snipe: waterfowl hunt days in free roam only (all Refuges) 	<ul style="list-style-type: none"> • Close pheasant hunting on all Refuges • Reduce number of hunt days on all Refuges • Increase closed zone acreage at Sacramento, Colusa, and Sutter NWRs 	Same as Alternative A plus: <ul style="list-style-type: none"> • Convert pheasant only unit to free roam on Colusa NWR • Allow limited spring turkey hunting on Sacramento, Delevan and Colusa NWRs 	Same as Alternative A plus: <ul style="list-style-type: none"> • Expand and convert a portion of the hunt area to pheasant only on Sacramento and Delevan NWRs • Allow limited spring and fall turkey hunting on Sacramento, Delevan, and Colusa NWRs • Allow snipe and dove hunting in all hunt areas on waterfowl hunt days
Overnight stay at hunter check stations	<ul style="list-style-type: none"> • Travel trailers and recreational vehicles allowed • All travel trailers stay in check station parking area • Tents are prohibited 	No overnight stay (must be off refuge 1 hour after lottery drawing until gates reopen 1 hour before reservations processed)	Same as Alternative A	Same as Alternative A except tents would be permitted.
Alcohol consumption while on Refuge	The use or possession of alcoholic beverages while hunting is prohibited (50 CFR 32.2j)	Same as Alternative A plus consumption or possession of an open container of alcohol within public areas on the Refuges is prohibited	Same as Alternative B	Same as Alternative A plus consumption or possession of an open container of alcohol in parking areas and on roadways in hunt area on the Refuges is prohibited

Issue	Alternative A No Action Alternative	Alternative B Emphasize Biological Resources Alternative	Alternative C Preferred Alternative	Alternative D Emphasize Visitor Services Alternative
Fishing	No fishing permitted on Refuges	Same as Alternative A	Same as Alternative A	Limited fishing access on Sacramento and Colusa NWRs
Wildlife Observation opportunities	<ul style="list-style-type: none"> • Sacramento NWR: 2 mile trail including 1 mile compacted gravel (marginal disabled access), 6 mile auto tour route, and observation platform • Colusa NWR: 1 mile trail, viewing blind, and 3 mile auto tour route • Provide facilities for 80,000 visits 	<p>Same as Alternative A except</p> <ul style="list-style-type: none"> • Prohibit buses, recreational vehicles, and bicycles on auto tour routes • Limit auto tour routes to weekend use only • Provide facilities for 60,000 visits 	<p>Same as Alternative A and</p> <ul style="list-style-type: none"> • Delevan NWR: construct viewing platforms on Maxwell Road and Four Mile Road • Sutter NWR: construct walking trail and add regular guided tours from April-June. • Colusa NWR: replace viewing blind and boardwalk for universal access • Expand hours on all Refuges to 1 hr. before sunrise to 1 hr. after sunset • Provide facilities for 100,000 visits • Open portions of hunt areas on Sacramento, Colusa, and Sutter NWRs from February – June 	<p>Same as Alternative C plus</p> <ul style="list-style-type: none"> • Provide facilities for 200,000 visits • Open entire hunt areas on Sacramento, Colusa, and Sutter NWRs and portions of the hunt area at Delevan NWR from February - June

Issue	Alternative A No Action Alternative	Alternative B Emphasize Biological Resources Alternative	Alternative C Preferred Alternative	Alternative D Emphasize Visitor Services Alternative
Photography	Sacramento NWR <ul style="list-style-type: none"> • 2 photo blinds • Auto tour & walking trail Colusa NWR <ul style="list-style-type: none"> • 1 photo blind • Auto tour & walking trail Provide for 33 annual photography visits	Photography from auto tour routes and walking trails only at Sacramento and Colusa NWRs	Same as Alternative A and <ul style="list-style-type: none"> • Sacramento NWR: construct wooden walkway and replace photo blind 2 for universal access • Delevan NWR: construct universal access photo blind • Allow photo blind use during spring-summer when habitat is suitable • Open portions of hunt areas on Sacramento, Colusa, and Sutter NWRs from February - June 	Same as Alternative C plus <ul style="list-style-type: none"> • Additional photo blind on Sacramento NWR • Open entire hunt areas on Sacramento, Colusa, and Sutter NWRs and portions of the hunt area at Delevan NWR from February - June
Environmental Education (EE) program	Staff facilitates activities for teachers to conduct EE activities for 2,500 teachers, students and adults annually	Same as Alternative A plus <ul style="list-style-type: none"> • Provide teacher workshops at Sacramento NWR • Construct and operate Wetland Resource Center at Sacramento NWR 	Same as Alternative B, plus conduct EE activities for 5,000 teachers, students and adults annually	Same as Alternative B plus provide staff-conducted activities in school classrooms

Issue	Alternative A No Action Alternative	Alternative B Emphasize Biological Resources Alternative	Alternative C Preferred Alternative	Alternative D Emphasize Visitor Services Alternative
Interpretation and Outreach	<ul style="list-style-type: none"> • Provide facilities and presentations for 14,000 annual on and off Refuge visits • Provide outreach both on and off Refuge by attending or organizing 11 special events 	Same as Alternative A plus construct and operate Wetland Resource Center at Sacramento NWR	Same as Alternative B plus increase the ability to support 20,000 annual visits both on and off Refuge	Same as Alternative B plus increase the ability to support 30,000 annual visits both on and off Refuge and provide additional off-Refuge outreach and on-Refuge interpretive facilities and materials
Volunteer program	<ul style="list-style-type: none"> • 69 volunteers, providing 1,700 hours annually, assisting with wildlife and habitat, maintenance, visitor service, and EE programs • 2 California Waterfowl Association-Visitor Service Assistants from November-February 	Same as Alternative A except focus volunteer activities on wildlife-oriented projects	Same as Alternative A and increase the number of volunteers to 120	Same as Alternative A except focus volunteer activities on visitor services program
Field Dog Trials	No field dog trials on refuges	Same as Alternative A	Same as Alternative A	Same as Alternative A
Non-wildlife dependant uses	Bicycling is allowed on the auto tour route at Sacramento NWR	Same as Alternative A except bicycling would not be allowed on the auto tour routes	Same as Alternative A, except allow bicycling in designated areas	Allow restricted uses of some non-wildlife dependant uses when and where compatible

Issue	Alternative A No Action Alternative	Alternative B Emphasize Biological Resources Alternative	Alternative C Preferred Alternative	Alternative D Emphasize Visitor Services Alternative
Law enforcement	<ul style="list-style-type: none"> • Two full-time officers, one dual-function officer, and regular assistance from regional zone officer • Regular assistance from State law enforcement • Regular and recurring law enforcement patrols year-round • Covert patrols during waterfowl season 	<ul style="list-style-type: none"> • Hire law enforcement supervisor • Hire additional law enforcement officer • Extensive regular and recurring law enforcement patrols of Refuges year-round • Increase covert patrols on the Refuges 	Same as Alternative B	Same as Alternative B
BIOLOGICAL				
Proportion of Managed Wetland Habitat Types	10-15% summer wetlands, 85-90% seasonal wetlands	Same as Alternative A	Optimally manage for 10-20% summer wetlands, 80-90% seasonal wetlands	Increase to 15-20% summer wetlands
Distribution of summer water habitat	Evenly distributed to the extent possible, but limited by water conveyance facilities in some areas	Develop infrastructure to allow for summer water units to be distributed throughout all Refuges, with optimal rotation options	Same as Alternative B	Same as Alternative B
Habitat Enhancement and Restoration	Implement annual habitat management plan (HMP) as funding allows	Fully implement annual HMP	Same as Alternative B	Same as Alternative B

Issue	Alternative A No Action Alternative	Alternative B Emphasize Biological Resources Alternative	Alternative C Preferred Alternative	Alternative D Emphasize Visitor Services Alternative
Invasive Species Management	Implement annual HMP as funding allows through chemical, biological and mechanical methods (2,000 acres)	Fully implement annual HMP (8,000 acres)	Same as Alternative B plus provide educational materials	Same as Alternative C
Biological monitoring of wildlife and habitat	Conduct 30 regular and special surveys annually	Expand the number of surveys to 40 and increase their frequency as needed	Same as Alternative B plus provide educational materials	Same as Alternative C
Vegetation management of Sutter Bypass to address flood flowage	Selective tree removal, focusing on groups or lines of trees running perpendicular to flood flows; reduction of understory and smaller trees in Northwest Grove	Limited tree removal based on biological resource needs	Same as Alternative A plus full implementation of Tree Reduction Operations Plan	Same as Alternative A
Mosquito Control	IPM approach that depends heavily on adulticiding from ground; continue same intensity of control without expanding geographic treatment areas	No active chemical mosquito control	IPM approach that relies on mostly larvicides, and strategically target greatest production areas; provide educational materials	Same as Alternative C plus sell insect repellent in the bookstore

Issue	Alternative A No Action Alternative	Alternative B Emphasize Biological Resources Alternative	Alternative C Preferred Alternative	Alternative D Emphasize Visitor Services Alternative
Fire Program	<ul style="list-style-type: none"> • Prescribed burn 500-600 acres/year • Limited fire effects monitoring • Treat 5-50 Wildland Urban Interface (WUI) acres/year with herbicide and/or mechanical treatment • Two heavy engine modules • Assistance from other agencies 	<ul style="list-style-type: none"> • Prescribed burn 2,000-3,000 acres/year • Fully implement organization chart • Increase fire effects monitoring • Treat 200-300 WUI acres/year • Increase Rural Fire Assistance program 	Same as Alternative B plus extensive education prevention programs	Same as Alternative C
Funding and Staffing Needs	Current funding and staffing levels	Increase funding and staffing to accomplish all priority biological tasks	Increase funding and staffing to accomplish a balance of biological and visitor services tasks	Increase funding and staffing to accomplish all visitor services tasks

Alternative A: Current Management (No Action)

Under this alternative (Figures 1-4), the Refuges would continue to be managed as they have been in the recent past (see Chapter 3 of the CCP). Recent management has followed existing step-down management plans:

- Annual Habitat Management Plans for Sacramento, Delevan, Colusa, and Sutter National Wildlife Refuges
- Fire Management Plan for Sacramento National Wildlife Refuge Complex
- Integrated Pest Management for Mosquito Control on Sacramento National Wildlife Refuge Complex
- Safety Plan
- Hazardous Tree Removal Plan

The focus of the Refuges would remain the same: to provide habitat and maintain current active management practices and continue to manage and provide habitat for threatened and endangered species, migratory and resident birds, and other wildlife. The Refuges would continue to provide wildlife-dependant recreation opportunities, including hunting, wildlife observation, photography, environmental education, and interpretation. Current staffing and funding levels would remain the same.

Habitat Management: Under Alternative A, the Service would continue to manage the habitat on the Refuges as described in detail in Chapter 3 of the CCP. The current annual habitat management plans would continue. HMP implementation and accomplishments would be limited due to insufficient funding levels, less than full staffing required, and non-biological program needs. Habitat would be managed to provide 10 to 15 percent summer wetlands and 80 to 95 percent in seasonal wetlands. Summer water would be evenly distributed to the extent possible, but would be limited by water conveyance facilities in some areas. Invasive species would also be managed as funding allowed (approximately 2,000 acres annually).

Prescribed fire would be used to accomplish annual habitat objectives (500-600 acres) on the Refuges. Annual WUI objectives (5-50 acres) would be met with prescribed fire, mechanical, or herbicide treatments.

Within the Sutter Bypass, trees would be selectively removed to address flood water conveyance. Removal of trees would be focused on those running perpendicular to flood flows and a reduction of understory and smaller trees in Northwest Grove.

Mosquito control would be managed using an IPM approach, depending heavily on ground applications of adulticides.

Biological monitoring would include approximately 30 surveys to aid in the evaluation of habitat management and the establishment of future plans.

Migratory Birds: Under this alternative, the Service would continue to restore, enhance, and manage wetlands, uplands, and other habitats to support an abundance of wintering waterfowl and other wetland-dependent birds and other migratory birds as described in Chapter 3 of the CCP. The Refuges would continue to conduct, coordinate and/or participate in existing survey and other monitoring efforts. Management-oriented research would be solicited, facilitated, and

otherwise supported when and where appropriate.

Threatened and Endangered Species: Under Alternative A, the Service would continue its habitat management program to support and improve habitat conditions for all threatened and endangered species occurring on the Refuges. Existing monitoring efforts would continue and management-oriented research would be solicited, facilitated, and supported, when and where appropriate.

Visitor Services: Under Alternative A, the Refuges' visitor services and facilities would continue unchanged to accommodate 22,000 annual hunter visits. Hunting of waterfowl, coot, common moorhen, snipe, and pheasant would be permitted on the southern portion of the Refuges on Saturdays, Sundays, and Wednesdays during the legal seasons. The hunting program selection process would be a State reservation system for all Refuges with an increased reservation draw at Colusa and Sutter Refuges. The type of waterfowl hunting would be a combination of spaced hunt areas, assigned ponds and free roam areas on the Refuges. Sacramento Refuge would have spaced blinds, assigned ponds, and free roam areas; Delevan Refuge would have spaced hunt sites (islands), assigned ponds, and free roam areas; Colusa Refuge would have assigned ponds and free roam areas; and Sutter Refuge would have free roam areas only.

There would be pheasant and snipe hunting on waterfowl hunt days in the free roam and pheasant only areas on all Refuges. There would also be pheasant hunting on the first Monday of the season in free roam, assigned pond, and spaced hunt sites on Sacramento, Delevan, and Colusa Refuges. There would also be pheasant only units on Sacramento, Colusa, and Sutter Refuges.

Overnight stay, using travel trailers and recreational vehicles, at the check stations would be allowed. Tents would be prohibited. The use or possession of alcoholic beverages while hunting would continue to be prohibited (50 CFR 32.2j).

The wildlife observation and photography programs and facilities on Sacramento and Colusa Refuges would include two auto tour routes, two walking trails, two viewing platforms, and three photography blinds. These facilities would support 80,000 annual visits including up to 33 photo blind visits.

The Refuges would continue its environmental education program which supports approximately 2,500 annual visits by teachers, parents and students, including the Earth Stewards and "Marsh Madness" youth programs and presentations by refuge staff to students. The interpretive program would continue to support 14,000 annual visits on and off Refuge by attending or organizing up to eleven special events, attending public meetings, and completing presentations or tours to conservation groups. The volunteer program would continue to involve approximately 69 volunteers, including two California Waterfowl Association-Visitor Services Assistant volunteers. Volunteers would continue to provide approximately 1,700 hours annually, assisting with recreation, environmental education, maintenance and wildlife habitat programs and projects.

Bicycling on the auto tour route on Sacramento Refuge would also continue to be permitted. Fishing, field dog trials and non-wildlife dependent uses (e.g. horseback riding, camping) would continue to be prohibited on the Refuges.

The law enforcement program would consist of two full-time refuge officers and one dual-function refuge officer that patrol the Refuges year-round. The Northern California Zone Officer stationed at the Complex would also provide regular assistance. The CDFG game wardens would continue to provide regular assistance.

Figure 1. Sacramento Refuge - Visitor Services Alternative A

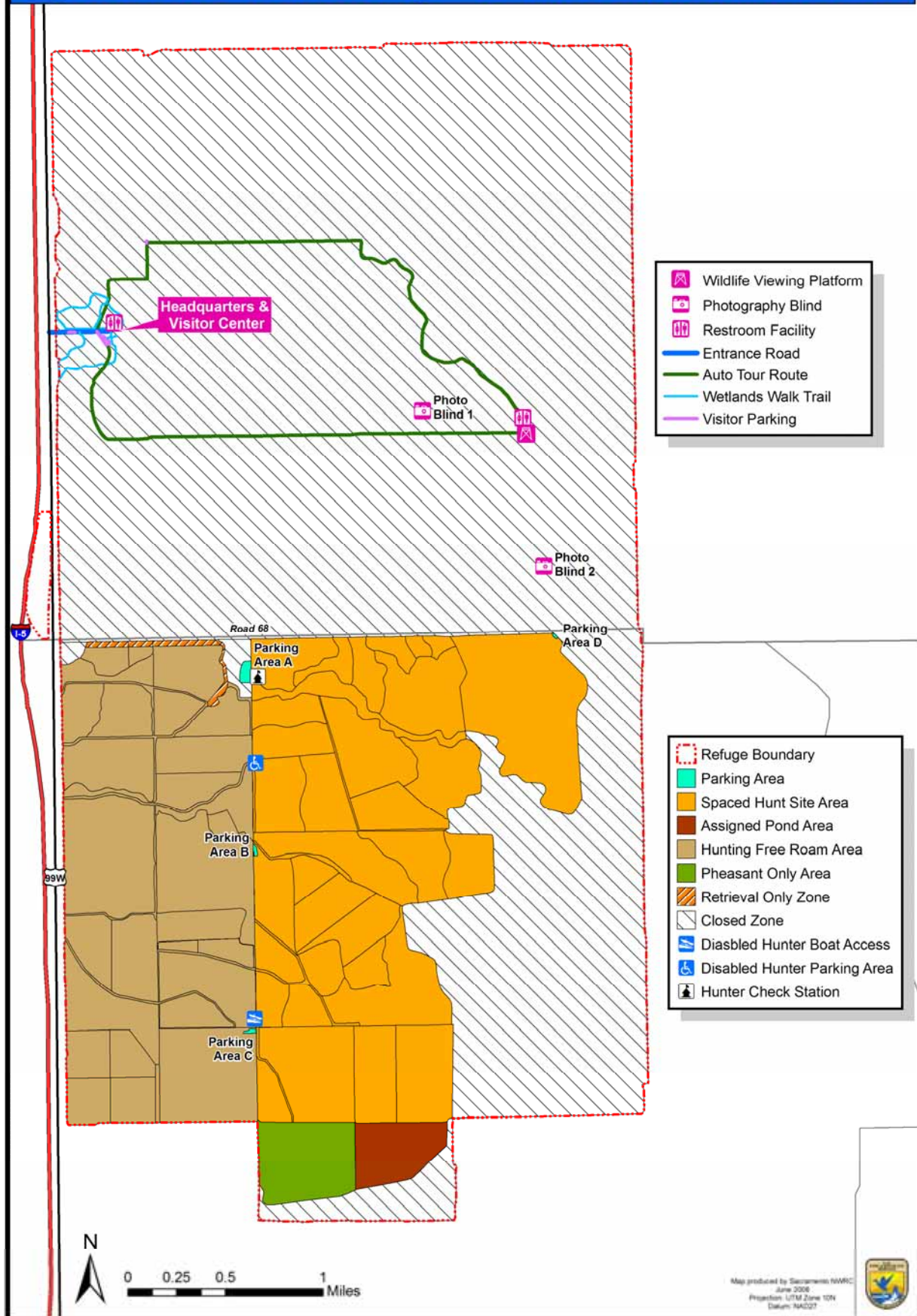


Figure 2. Delevan Refuge - Visitor Services Alternative A

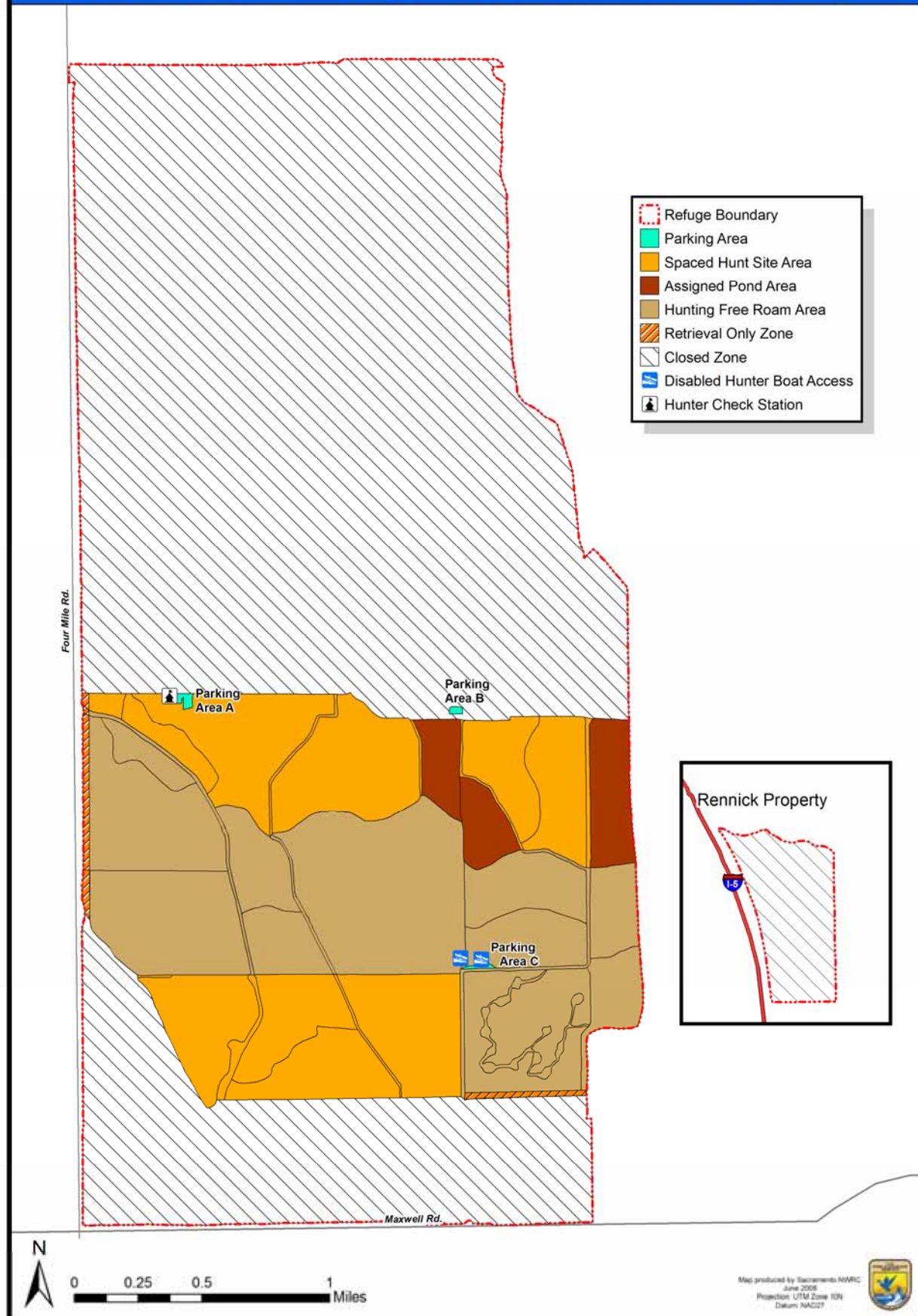


Figure 3. Colusa Refuge - Visitor Services Alternative A

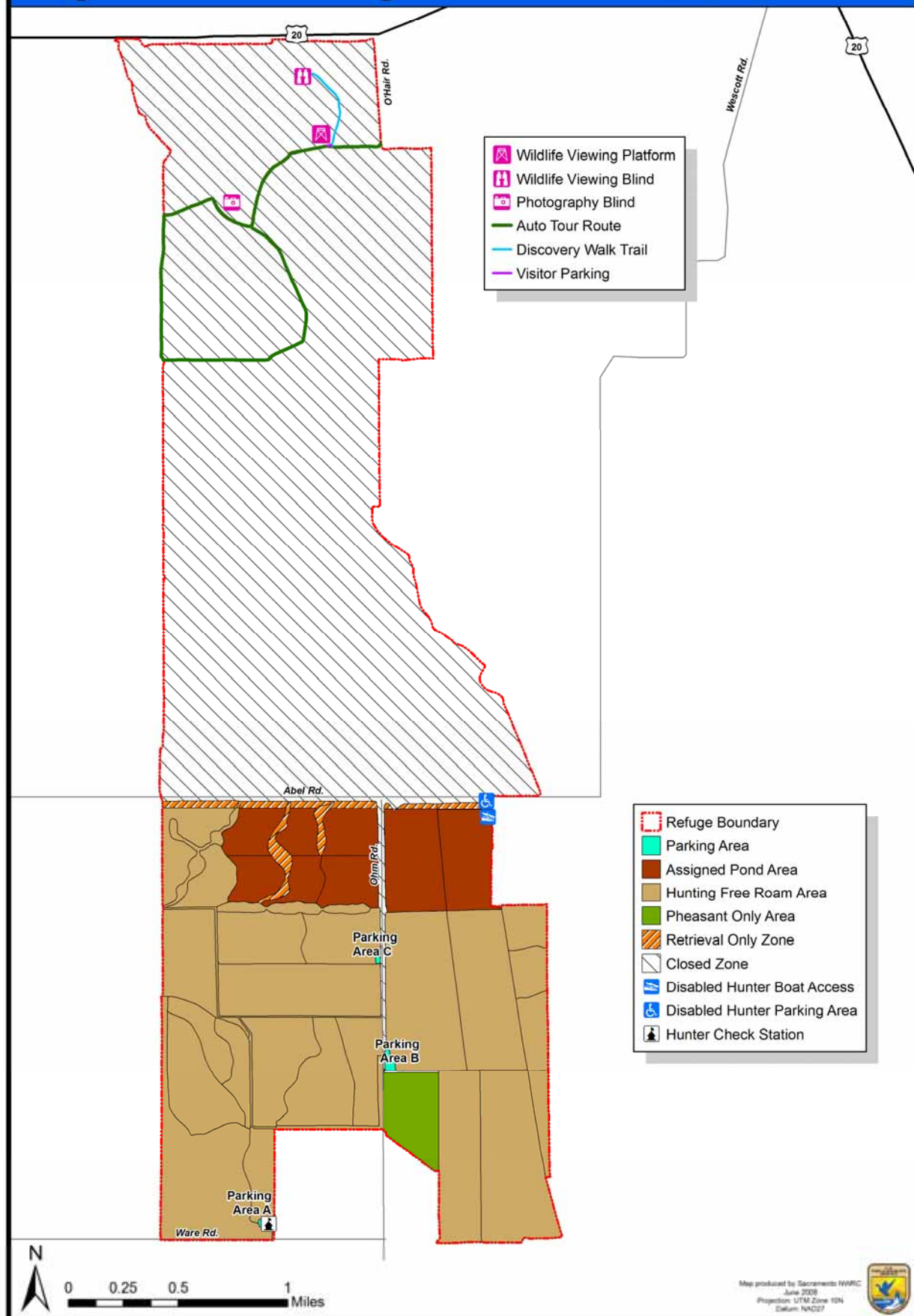
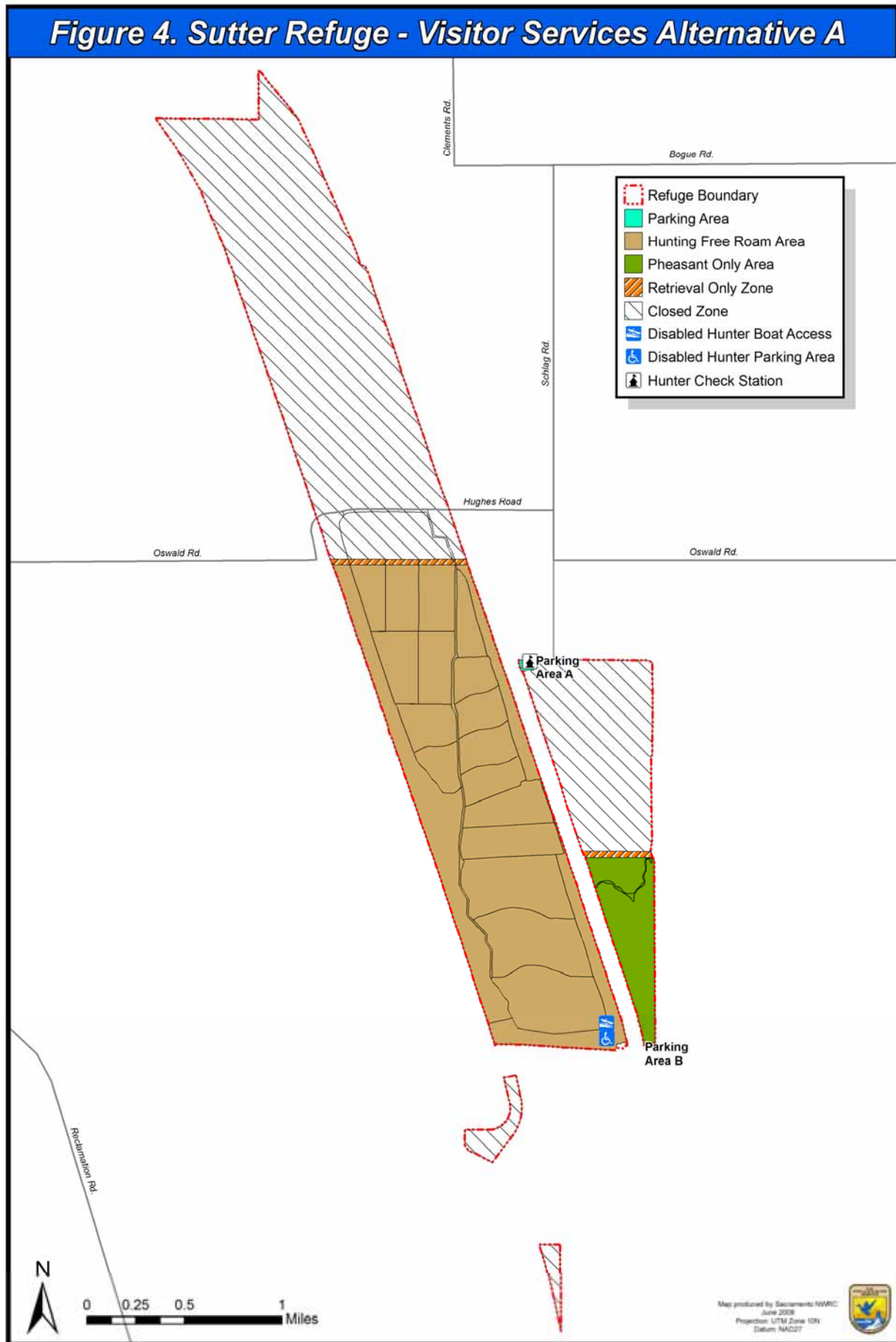


Figure 4. Sutter Refuge - Visitor Services Alternative A



Alternative B: Emphasize Biological Resources Alternative

Under this alternative, the Refuges would emphasize management for biological resources (Figures 5-8). Biological opportunities would be maximized to allow optimum wildlife and habitat management throughout the majority of the Refuges. In addition, staffing and funding levels would need to be redirected and increased to fully implement this alternative.

Habitat Management: Under Alternative B, the Refuges would be managed almost entirely based upon the quantity and quality of habitat needed for maximum biological benefits, with much less focus on and sometimes at the expense of other Refuge programs, such as visitor services, or outside concerns, such as flood control or mosquito abatement. Refuge staff would complete a greater percentage of biological tasks identified in the individual annual HMPs and IPM Plan every year. These efforts would include habitat restoration or enhancement, control measures on all areas with identified invasive plant species problems on approximately 8,000 acres, all levee and water control structure repairs and replacements, etc.

Prescribed fire would be used to accomplish annual habitat objectives (2,000 to 3,000 acres) on the Refuges. Annual WUI objectives (200 to 300 acres) would be met with prescribed fire, mechanical, or herbicide treatments. This alternative would increase fire staff, fire effects monitoring, and the Rural Fire Assistance Program.

Tree removal in the Sutter Bypass would be limited to only those based upon biological resource needs.

Active chemical mosquito control on the Refuges would be eliminated.

Biological monitoring would be expanded to include approximately 40 surveys on a more frequent basis to aid in the evaluation of habitat management and the establishment of future plans.

Migratory Birds: Under Alternative B, habitat management would be maximized to provide the greatest level of benefit to waterfowl, other wetland-dependent birds, and other migratory birds. Food and cover production, water quality, and availability based on annual abundance and migratory patterns would be optimized. Invasive species would be controlled to the greatest extent possible, fully implementing annual HMPs. Visitors would be managed to keep disturbance at the lowest level, relative to the other alternatives. Relative to Alternative A, the number and frequency of surveys would be increased to monitor a more comprehensive list of migratory bird species and the habitat upon which they depend. Examples would include a greater level of monitoring for abundance/distribution of waterfowl, shorebirds, secretive waterbirds, raptors, Neotropical migrants, vegetation in all habitat types, aquatic and terrestrial insects, and other species or habitat communities.

Threatened and Endangered Species: Under Alternative B, habitat management would be maximized to provide the greatest level of benefit to threatened and endangered species. By fully implementing the annual HMPs, the refuge staff would maximize monitoring efforts and efforts to control exotic and invasive species in existing threatened and endangered species habitats. Natural hydrology would be maintained or restored in alkali meadow and vernal pool habitats. Research designed to determine beneficial habitat management techniques and population abundance/distribution would continue to be encouraged to the greatest extent possible.

Visitor Services: Under Alternative B the visitor services programs and facilities would be reduced to optimize wildlife and habitat management. The hunting program would be reduced with increased closed zone acreage on Sacramento, Colusa, and Sutter Refuges, fewer hunt days, a hunter selection process by reservation only with no refills, only spaced blinds and/or assigned ponds on all Refuges, no pheasant hunting, and no overnight stays allowed. The consumption or possession of an open container of alcohol by the public on the Refuges would be prohibited.

In an effort to reduce disturbance, the wildlife observation programs and facilities would be reduced (60,000 annual visits); this would include limiting auto tour routes to weekend use only and prohibiting buses, recreational vehicles (RVs), and bicycles on the auto tour routes. The photography program would also be reduced. All photography blinds would be eliminated and photography would be limited to auto tour routes and walking trails only on Sacramento and Colusa Refuges.

A Wetland Resource Center would be constructed and more teacher workshops would be held in an effort to “centralize education” and minimize disturbance impacts in habitats. The Wetlands Resource Center would be located on the east side of Logan Creek between the existing headquarters and easement buildings. A wetland could be created south of the Center for habitat viewing and environmental education activities. A foot bridge would be constructed over Logan Creek so that the current parking area and Wetlands Walk may be used. The Center could be a one-story building with a covered viewing porch at roof height. Large picture windows would accommodate views to the south and west. Part of the entry area would descend below the pond surface to allow visitors to view aquatic organisms and soil profiles. An auditorium would provide seating for up to 100 and include a surround-sound system, High Definition (HD) television, and retracting screens for projectors, videos, and DVDs. Separate laboratory rooms would provide a secluded work area, storage and sinks. Computer work stations with internet/satellite access and a resource library would be available for students and teachers.

The interpretation program would be the same as described in Alternative A. The volunteer program would remain as described in Alternative A, except volunteers would focus on wildlife oriented projects. Fishing, field dog trials and non-wildlife dependent uses (e.g. horseback riding, camping) would continue to be prohibited on the Refuges.

The law enforcement program would remain as described in Alternative A. In addition, the Service would hire an additional full-time refuge officer and a law enforcement supervisor. Patrols on the Refuges would be increased year-round.

Figure 5. Sacramento Refuge - Visitor Services Alternative B

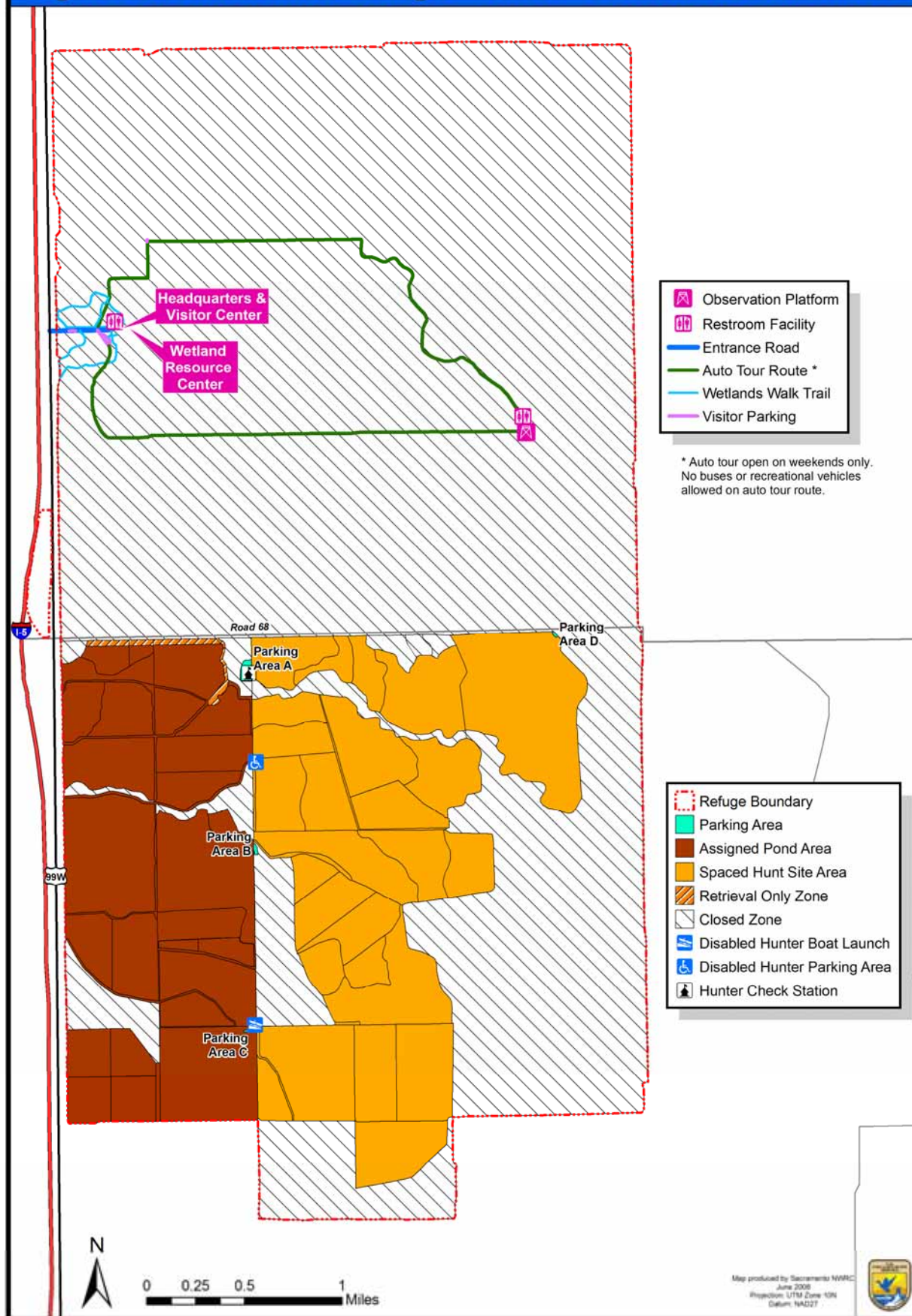


Figure 6. Delevan Refuge - Visitor Services Alternative B

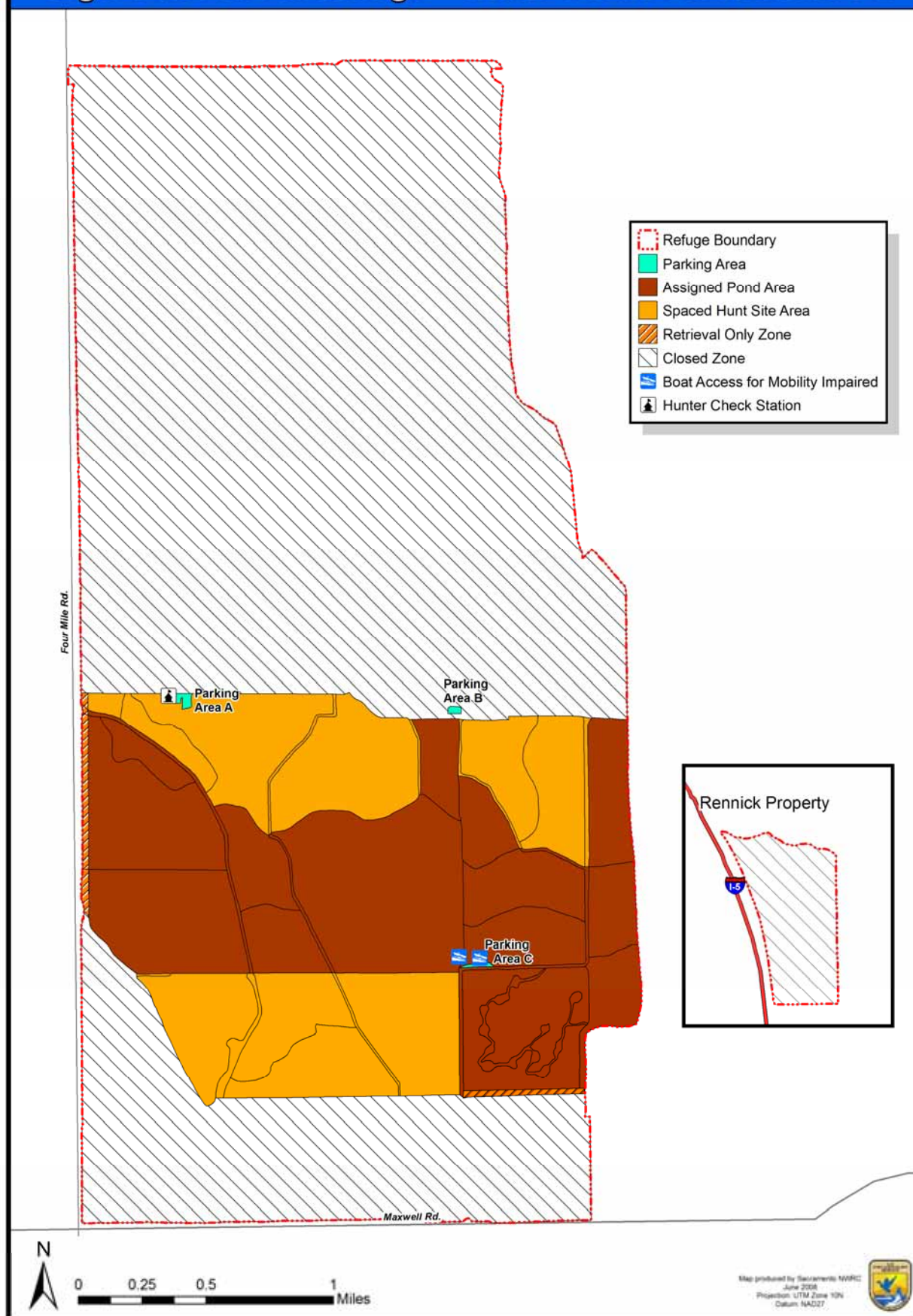


Figure 7. Colusa Refuge - Visitor Services Alternative B

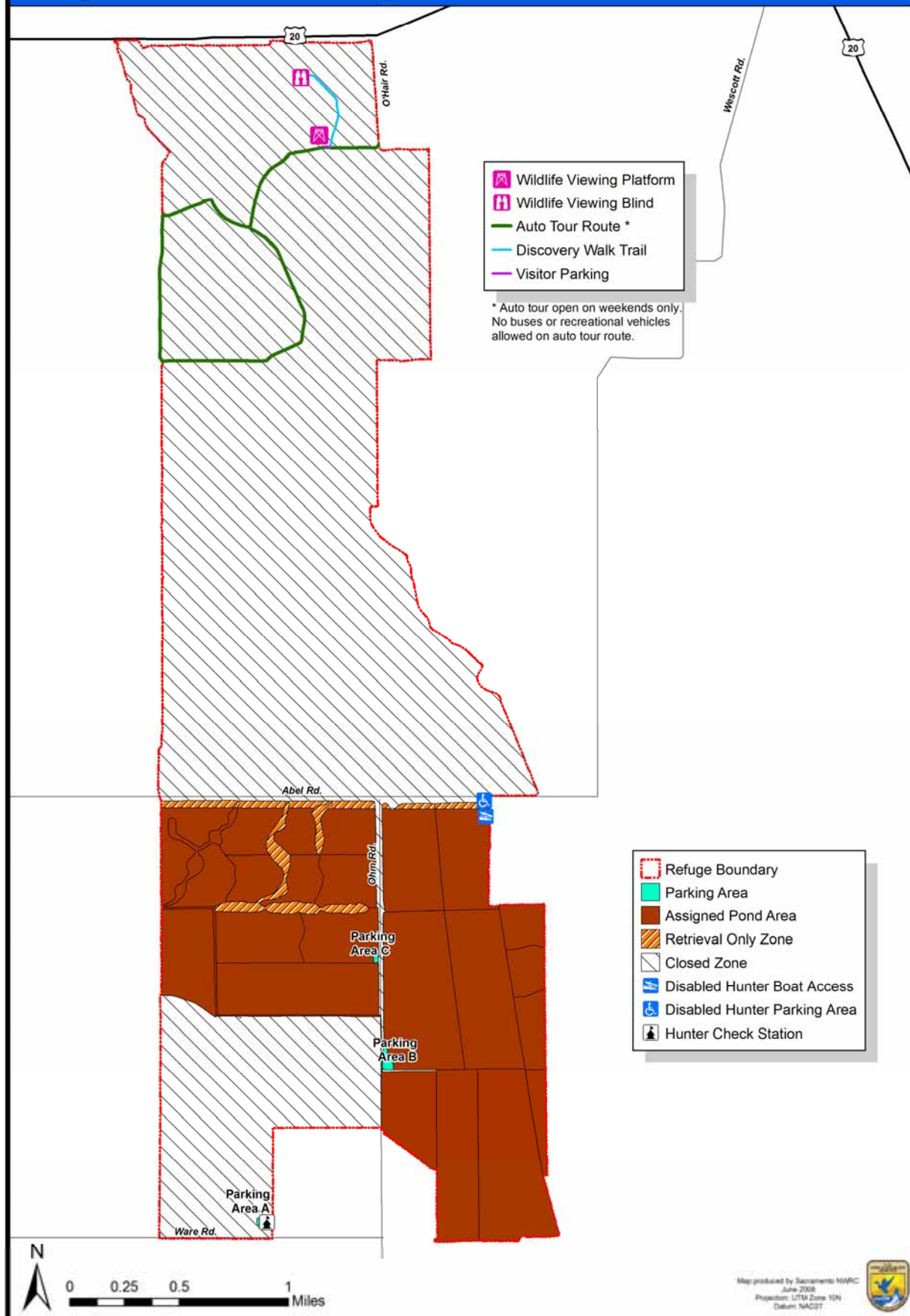
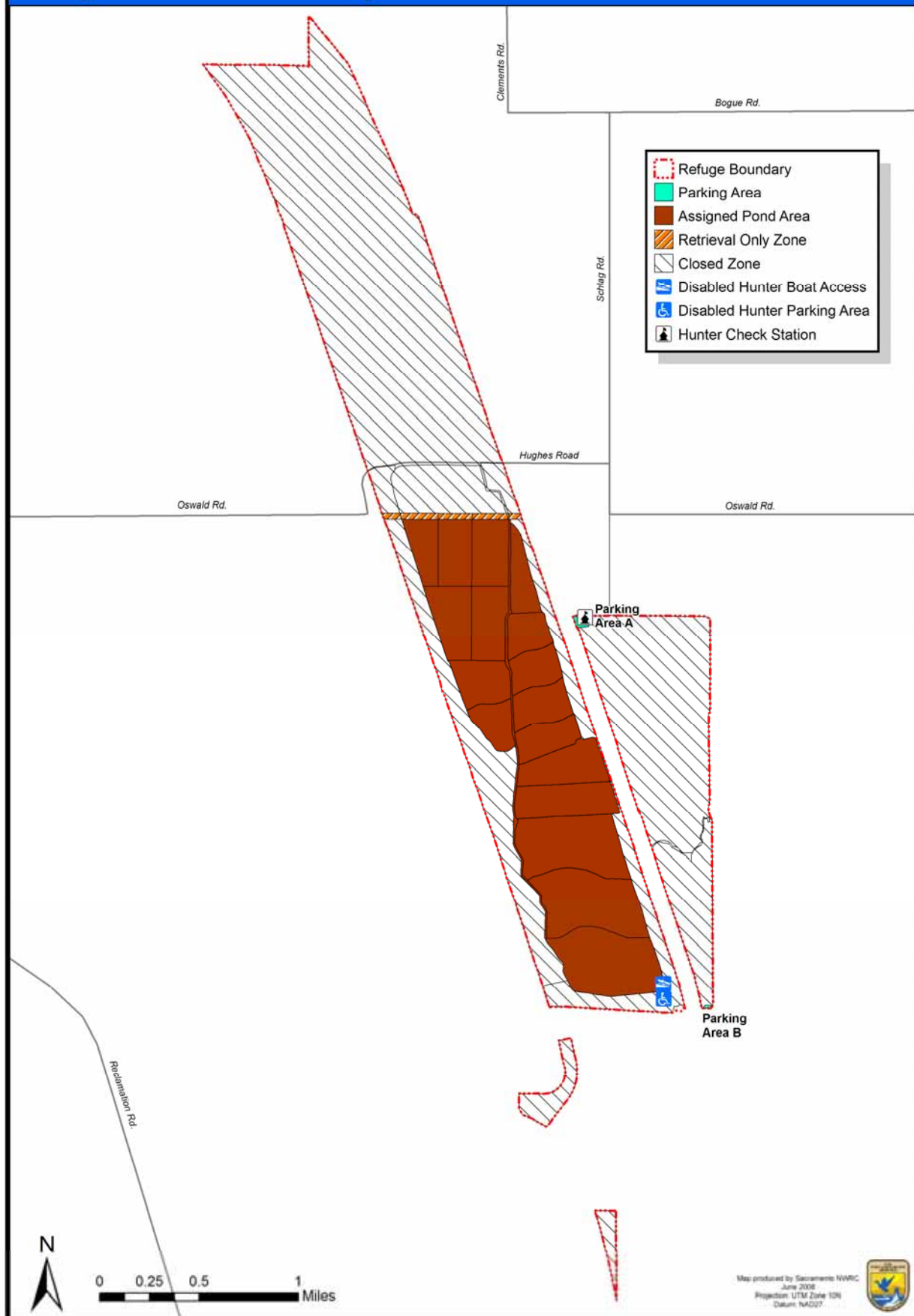


Figure 8. Sutter Refuge - Visitor Services Alternative B



Alternative C: Preferred Alternative

Alternative C (Figures 9-12) would achieve an optimal balance of biological resource objectives and visitor services opportunities. Habitat management and associated biological resource monitoring would be improved. Visitor service opportunities would focus on quality wildlife-dependant recreation distributed throughout the Refuges. Staffing and funding levels would need to be increased to fully implement this alternative.

Habitat Management: Under Alternative C, managed wetland habitat types would be the same as Alternative A, except the percentage of summer wetlands would have an increased range from 10 to 20 percent. Habitat monitoring and restoration/enhancement activities, summer water distribution, invasive species management, and biological monitoring would all be the same as Alternative B. Within the Sutter Bypass, selective tree removal to address flood water conveyance concerns would be accomplished at Sutter Refuge as in Alternative A. In addition, the Refuge would fully implement the Tree Reduction Operations Plan. Unlike Alternatives A and B, mosquito control on the Refuges would use an IPM approach, relying mostly on larvicides and targeting the greatest larval production areas.

As in Alternative B, prescribed fire would be used to accomplish annual habitat objectives (2,000 to 3,000 acres) on the Refuges. Annual WUI objectives (200 to 300 acres) would be met with prescribed fire, mechanical, or herbicide treatments. This alternative would also increase fire staff, fire effects monitoring, and the Rural Fire Assistance Program compared to Alternative A. In addition, extensive education prevention programs would be implemented.

Migratory Birds: Refuges would be managed similar to Alternatives A and B, but Alternative C provides for maximum flexibility to manage summer wetlands for breeding species, such as tricolored blackbirds, white-faced ibis, breeding/molting waterfowl, and other summer wetland-dependent birds. Biological monitoring would be the same as described in Alternative B.

Threatened and Endangered Species: Under Alternative C, there would be an increase in habitat availability for giant garter snakes as a result of any increases in summer wetlands relative to Alternatives A and B.

Visitor Services: Under Alternative C, the visitor services and facilities would optimize a balance of quality wildlife-dependent recreation throughout the Refuges. The hunting program at Sutter Refuge would change to include a hunter selection process that uses a prioritized system via reservation first, then lottery, and then first-come, first served to be consistent with the hunter selection process on all the other Refuges. In addition, a combination of free roam and assigned ponds would be offered on Sutter Refuge. Sacramento Refuge would convert some spaced blinds to assigned ponds. Colusa Refuge would convert some free roam area to assigned ponds. The pheasant only area on Colusa Refuge would also be converted to free roam. Over night stays would remain as described in Alternative A.

Limited spring turkey hunting opportunities on Sacramento, Delevan, and Colusa Refuges could be allowed based on sufficient wild turkey populations, habitat conditions, and the development of a turkey hunt management plan, as well as appropriate NEPA compliance.

As in Alternative A, the consumption or possession of an open container of alcohol within public areas on the Refuges would be prohibited. Fishing on all Refuges would remain prohibited.

The wildlife observation and photography programs and facilities would be expanded to 100,000 annual visits. Visitation time on the auto tour routes and trails would also be expanded to one hour before sunrise to one hour after sunset. Viewing platforms at Delevan Refuge would be constructed adjacent to Maxwell Road and Four Mile Road. A universally accessible blind would replace photo blind #2 on Sacramento Refuge, another universally accessible photography blind would be constructed at Delevan Refuge, and use of photo blinds during the spring and summer would be allowed when habitat conditions are suitable. The observation blind at Colusa Refuge would be replaced with a universally accessible blind and boardwalk.

Portions of the hunt areas would be opened from February through June for wildlife observation and photography on Sacramento, Colusa, and Sutter Refuges. This alternative provides the opportunity for visitors to observe wildlife without being restricted to auto tour routes and walking trails. Visitors would utilize the existing blind, assigned pond, and free roam boundary signs to access the areas. Boundary closed signs would be added and taken down seasonally. Also, a walking trail would be added to Sutter Refuge and regular guided tours would be provided as funding or staff allows from April-June.

The visitor facilities and interpretive programs would expand to support 20,000 annual visits. A Wetland Resource Center would be constructed (as described in Alternative B) and environmental education activities would be conducted for 5,000 teachers, students, and adults annually. Volunteer recruitment would take place in order to increase the number of current volunteers from 69 to 120.

Bicycling would be allowed on the entrance roads and auto tour routes from May through August on Sacramento and Colusa Refuges. Other non-wildlife dependent uses (e.g. field dog trials, horseback riding, camping) would continue to be prohibited on the Refuges.

The law enforcement program would remain as described in Alternative B.

Figure 9. Sacramento Refuge - Visitor Services Alternative C

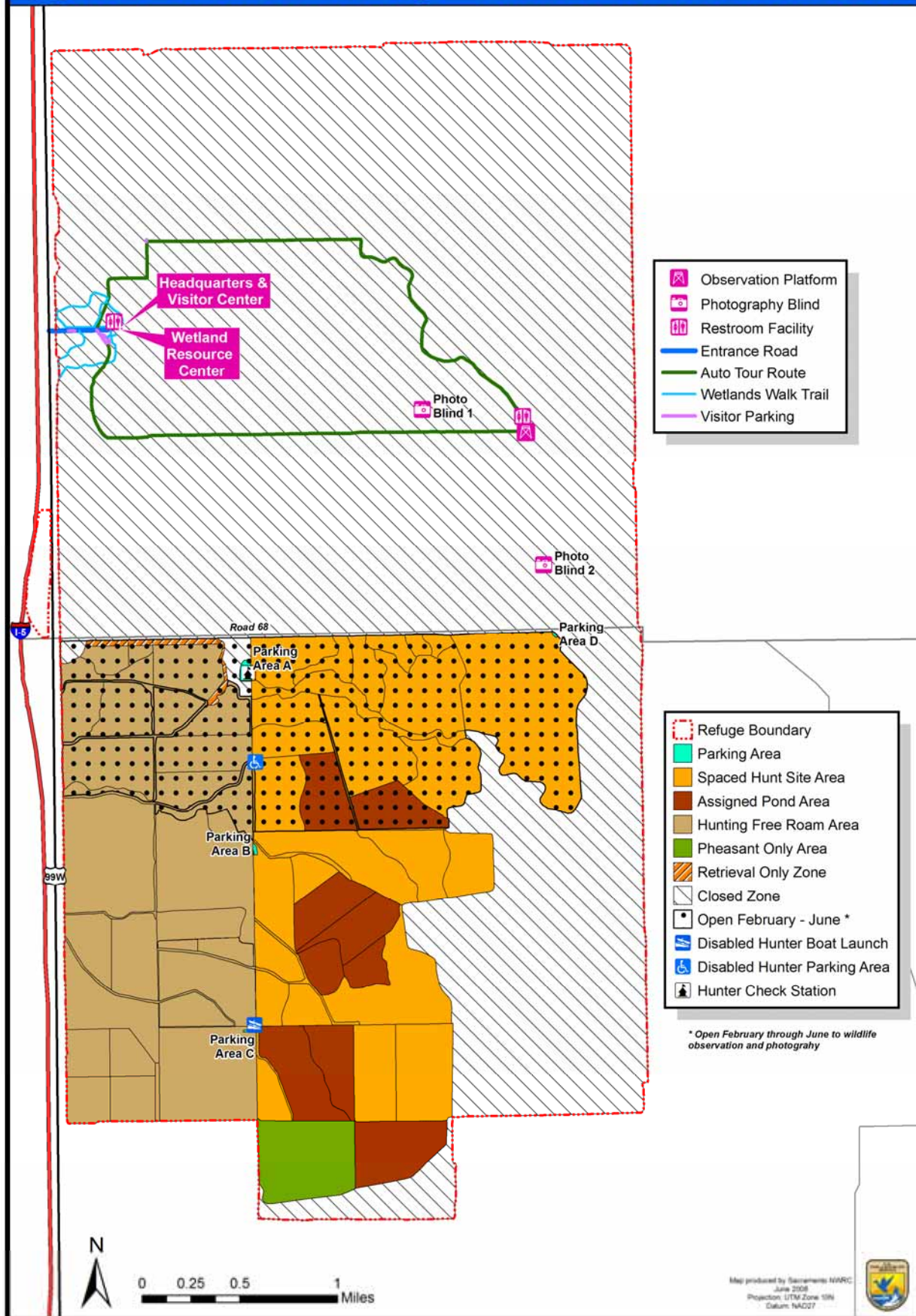


Figure 10. Delevan Refuge - Visitor Services Alternative C

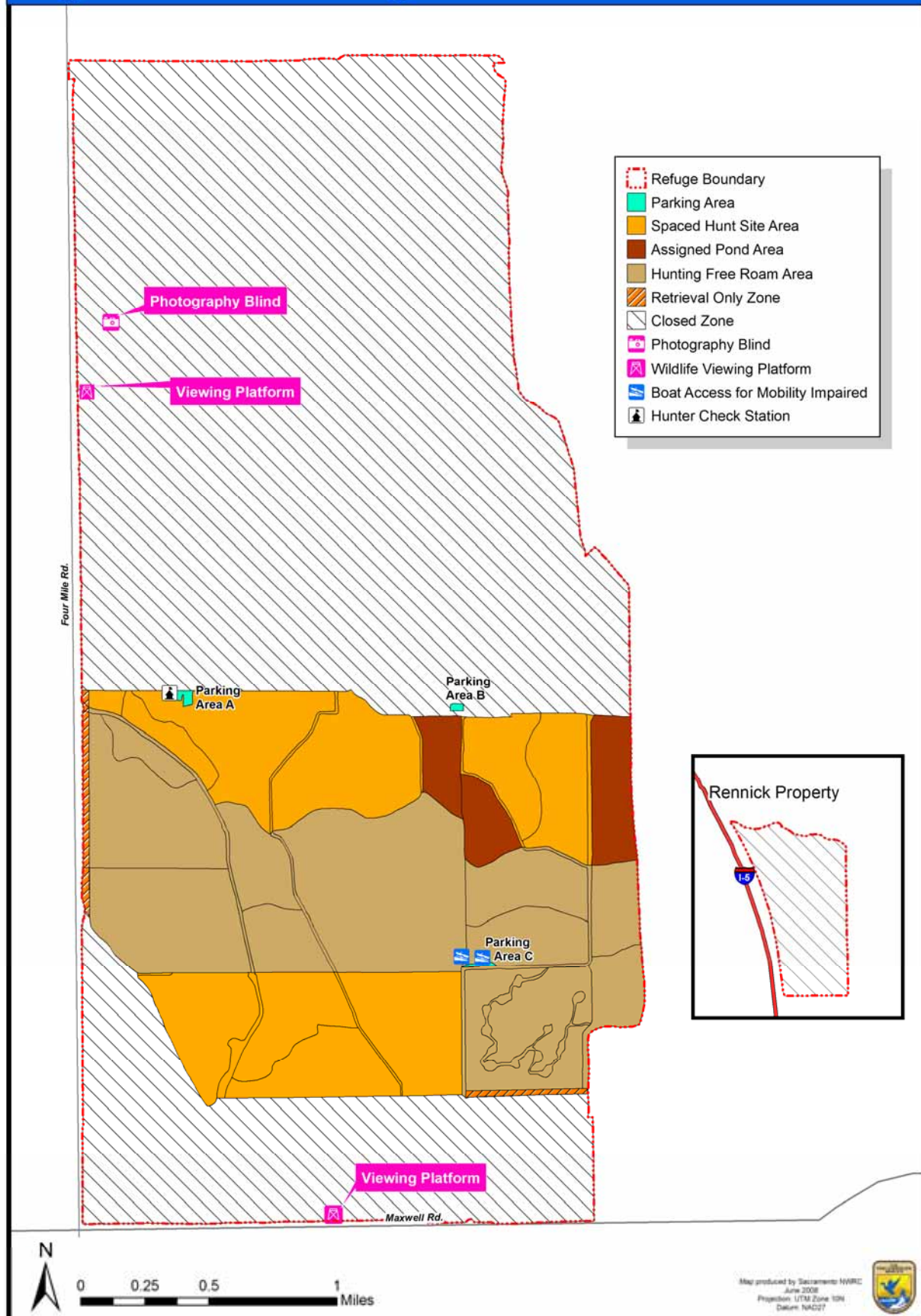


Figure 11. Colusa Refuge - Visitor Services Alternative C

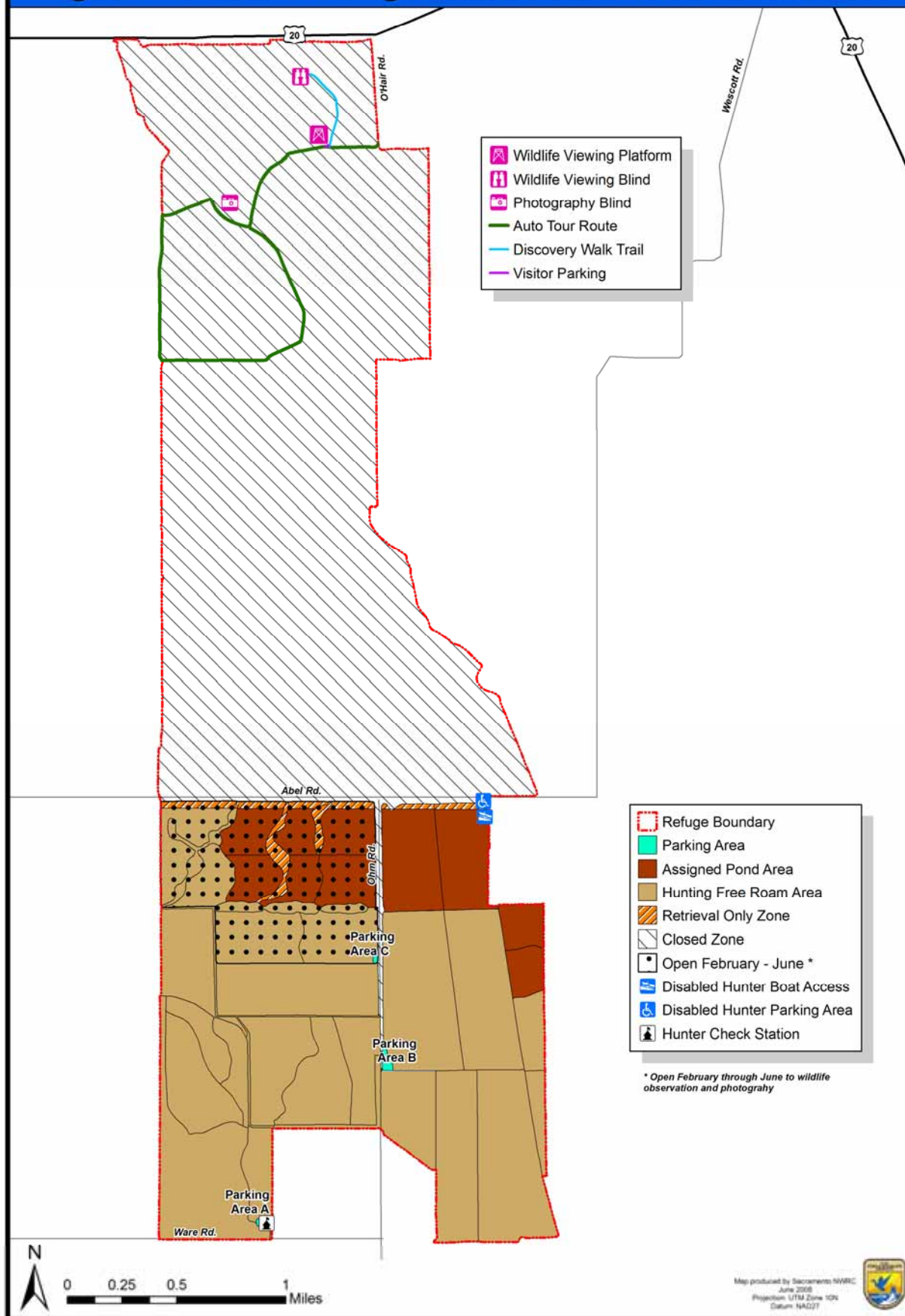
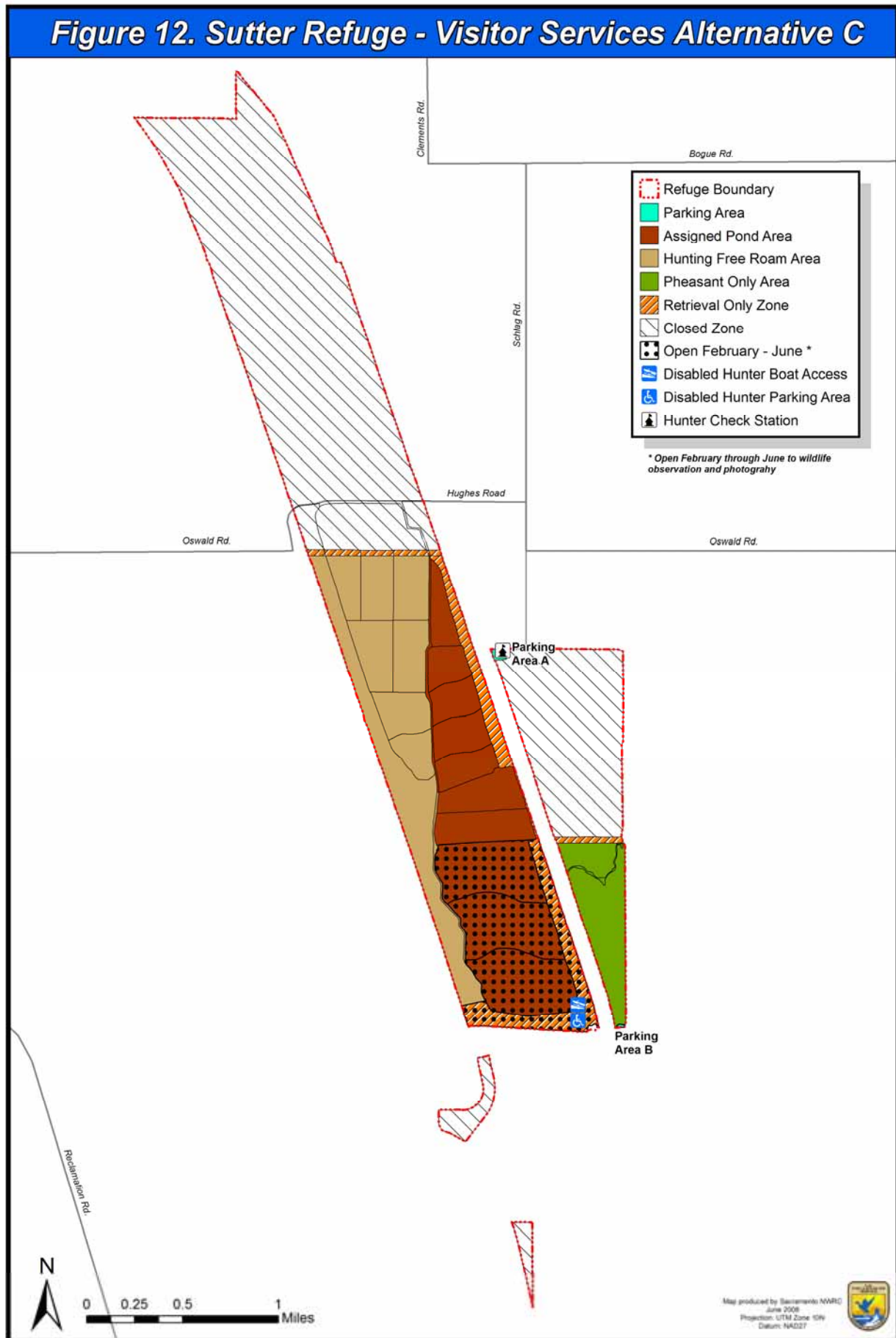


Figure 12. Sutter Refuge - Visitor Services Alternative C



Alternative D: Emphasize Visitor Services Alternative

Under Alternative D (Figures 13-16), the Refuges would emphasize management for visitor services. Wildlife-dependant recreational opportunities would be expanded on the Refuges. However, staffing and funding levels would need to be redirected and increased substantially to implement this alternative.

Habitat Management: Under Alternative D, the proportion of managed wetland habitat types would be modified to provide an increase to 15 to 20 percent in summer wetland acres. As in Alternative B, the water conveyance infrastructure would be expanded to allow for semi-permanent water to be distributed throughout all Refuges, and to provide optimal rotation (from/to other water regimes) options. As in Alternatives B and C, the annual HMPs and IPM Plan would be fully implemented. As in Alternatives A and C, trees within the Sutter Bypass would be selectively removed to maintain/improve flood flowage capacity and there would be a reduction of understory and smaller trees in the Northwest Grove. Biological monitoring would be the same as described for Alternative C. Mosquito control would remain the same as described in Alternative C, plus insect repellent would be sold in the bookstore. Annual prescribed fire and WUI objectives would be the same as described in Alternative C.

Migratory Birds: Under Alternative D, the greatest amount and consistency of summer wetlands would be provided, relative to the other alternatives. This would provide maximum reproduction habitat for waterfowl, tricolored blackbirds, white-faced ibis, and other summer wetland-dependent birds, relative to the other alternatives. There would be a potential decrease in habitat quality for wintering waterfowl as additional seasonal wetlands were converted to summer wetlands relative to the other alternatives.

Threatened and Endangered Species: Relative to the other alternatives, under Alternative D there would be an increase in habitat availability for giant garter snakes as a result of any increases in summer wetlands. Increases in summer wetlands and activation of supporting water conveyance systems would create some additional risk of affecting vernal pool plant and animal species by unintentional flooding.

Visitor Services: Under Alternative D, the visitor services and facilities would emphasize wildlife-dependent recreation throughout the Refuges. The hunting program would be the same as described in Alternative C except additional units on Sacramento and Delevan Refuges would be opened or converted to pheasant only hunting. Also, dove and snipe hunting on all hunt areas on the Refuges on waterfowl hunt days would be allowed. Appropriate NEPA compliance would be completed prior to allowing dove hunting on the Refuges.

Limited spring and fall turkey hunting opportunities on Sacramento, Delevan, and Colusa Refuges could be allowed based on sufficient wild turkey populations, habitat conditions, and the development of a turkey hunt management plan, as well as appropriate NEPA compliance.

Overnight stay at hunter check stations would be expanded to allow use of tents. The consumption or possession of an open container of alcohol in parking areas and on roadways in hunt areas on the Refuges would be prohibited.

Limited fishing on Sacramento and Colusa Refuges would be allowed. Appropriate NEPA compliance would be completed prior to allowing fishing on the Refuges.

The wildlife observation and photography programs and facilities would be expanded to support 200,000 annual visits. An additional photography blind on Sacramento Refuge would be constructed. The entire hunt areas on Sacramento, Colusa, and Sutter Refuges and portions of the hunt area at Delevan Refuge would be opened for wildlife observation and photography from February through June.

The visitor facilities and interpretive programs would expand to support 30,000 annual visits. Additional off-Refuge outreach activities would take place. The environmental education program would remain the same as described in Alternative B with the addition of staff-conducted activities in school classrooms. A Wetland Resource Center would be constructed (as described in Alternative B), more teacher workshops would be held, and refuge staff would visit schools to conduct Refuge related activities.

The volunteer program would be the same as described in Alternative A, except they would focus on visitor services projects. As in Alternative C, bicycling on Sacramento and Colusa Refuges entrance roads and auto tour routes from May through August would be allowed. Other non-wildlife dependent uses could be allowed on Refuges where and when determined to be compatible. Field dog trials would continue to be prohibited on the Refuges.

The law enforcement program would remain as described in Alternative B.

Figure 13. Sacramento Refuge - Visitor Services Alternative D

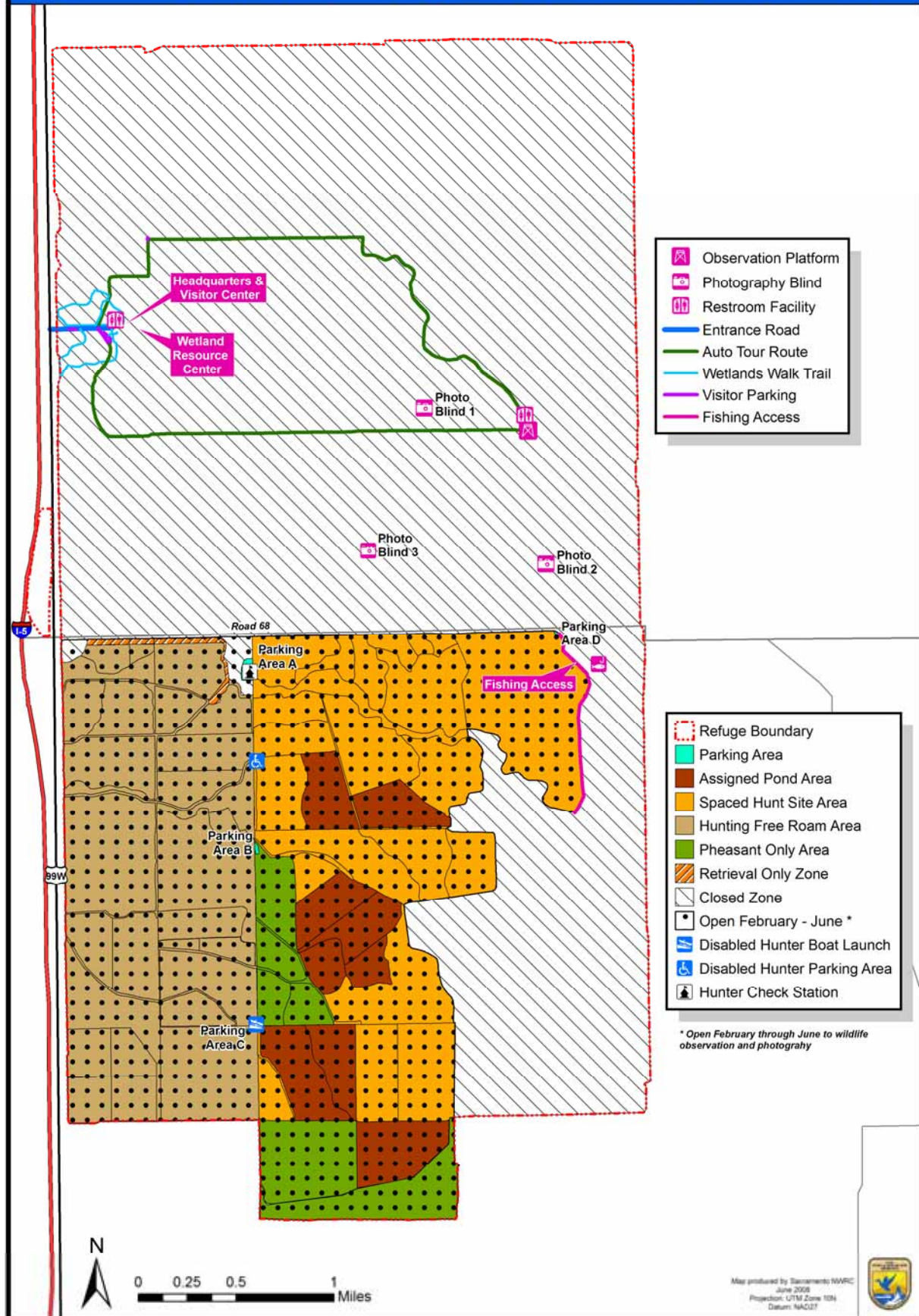


Figure 14. Delevan Refuge - Visitor Services Alternative D

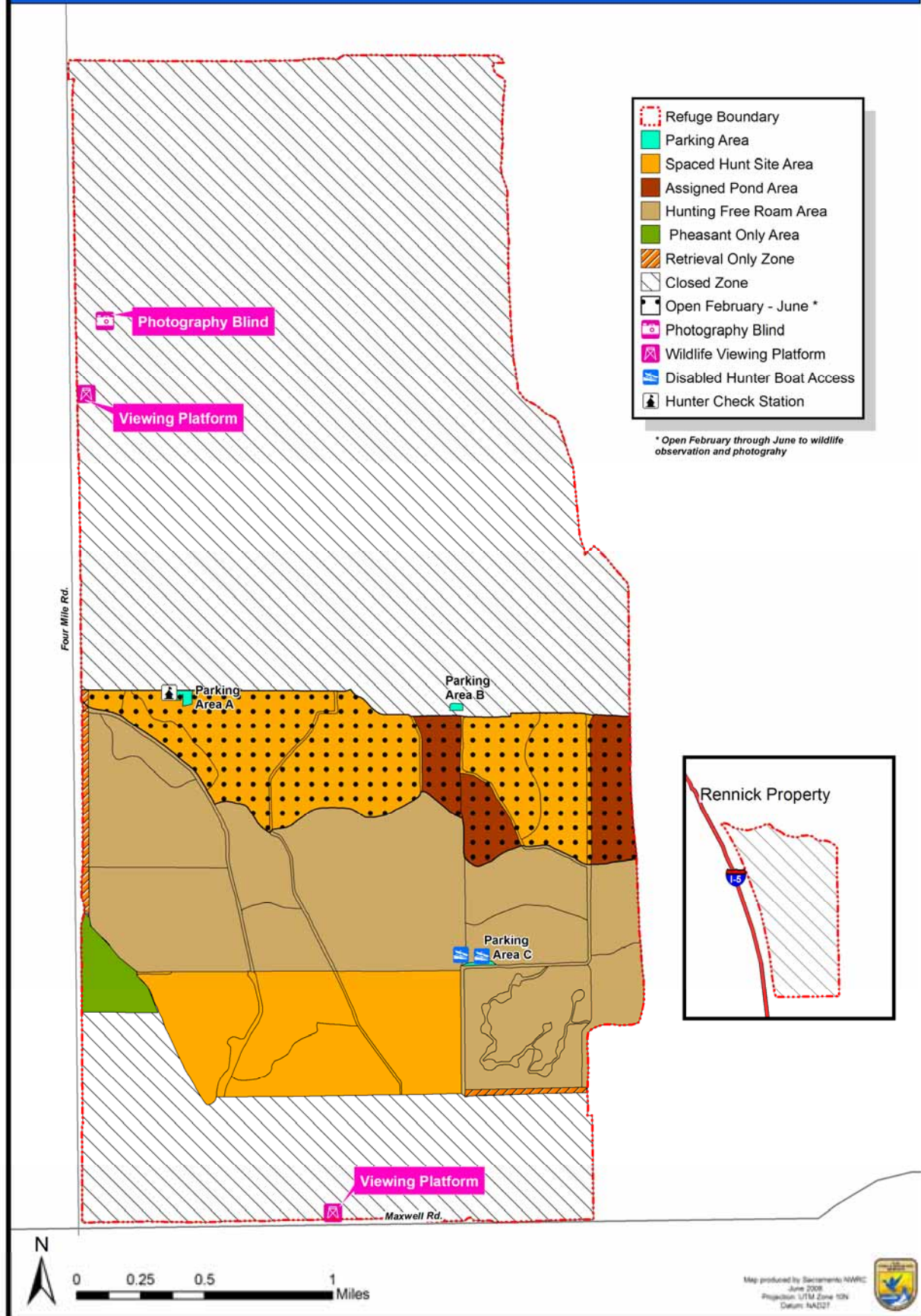
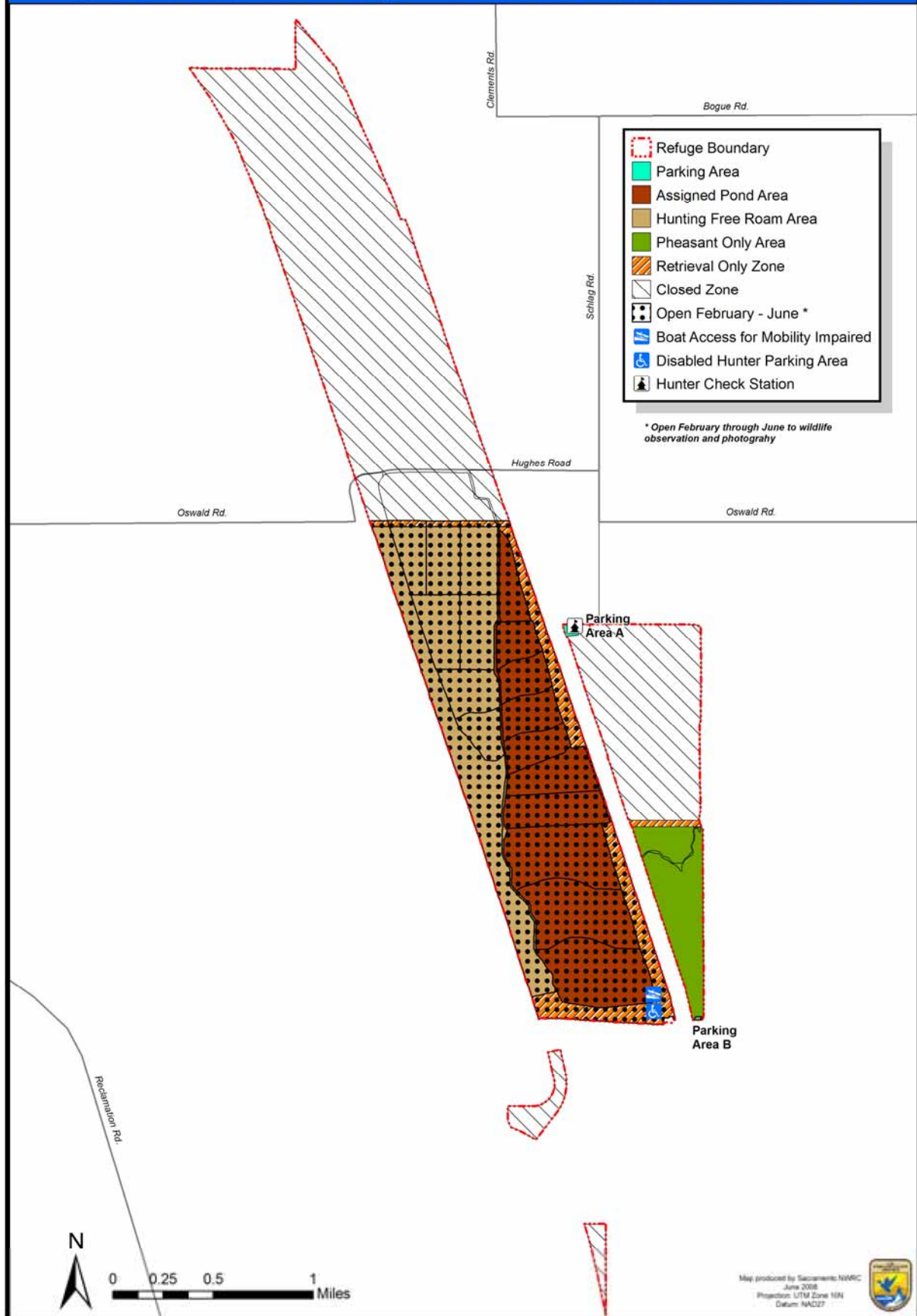


Figure 15. Colusa Refuge - Visitor Services Alternative D



Figure 16. Sutter Refuge - Visitor Services Alternative D



Chapter 3. Affected Environment

This chapter briefly outlines the physical, biological, social, and economic environment that would most likely be affected by the alternatives. See Chapter 3 of the CCP for a more detailed description.

Physical Environment

Chapter 3 of the CCP provides a detailed description of the physical environment.

Biological Environment

Chapter 3 of the CCP provides a detailed description of the biological environment.

Social and Economic Environment

Chapter 3 of the CCP provides a detailed description of the social and economic environment.

It is important to note that “economic or social effects are not intended by themselves to require preparation of an environmental impact statement. When an environmental impact statement is prepared and economic or social and natural or physical environmental effects are interrelated, then the environmental impact statement will discuss all of these effects on the human environment” (40 CFR 1508.14). In assessing the physical and biological effects of changing land use on certain pieces of land, the EA has appropriately addressed the interrelated potential social and economic impacts.

Chapter 4. Environmental Consequences

This chapter analyzes the environmental impacts expected to occur from the implementation of the alternatives described in Chapter 2. Impact evaluation has been conducted for each aspect of the environments described in Chapter 3, including physical, biological, and social and economic resources. Direct, indirect, and cumulative impacts are described, where applicable, for each alternative. Alternative A (No Action) is a continuation of management practices that are in place today and serves as a baseline against which Alternatives B, C, and D are compared. Table 2 contains a comparison of the environmental consequences for each of the alternatives.

The National Environmental Policy Act requires mitigation measures be identified and discussed for adverse impacts to habitats, wildlife, or the human environment. None of the activities proposed under Alternative C are expected or intended to produce significant levels of environmental impacts that would require mitigation measures. Nevertheless, the CCP contains measures that would preclude significant environmental impacts from occurring. The Service is proposing mitigation measures in an effort to avoid having CCP implementation result in significant adverse effects. An agency may support a conclusion of less than significant effects by showing that mitigation measures will significantly compensate for a proposed action's adverse environmental impacts (Friends of Endangered Species v. Jantzen, 760 F.2d 976, 987 (9th Cir. 1985)).

In describing the significance of impacts, the Service defers to NEPA Implementing Regulations at 40 CFR 1508.27.

"Significantly" as used in NEPA requires considerations of both context and intensity:

(a) Context. This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.

(b) Intensity. This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action."

Significance of impacts to the human environment determines whether preparation of an EIS is warranted. Thus, an EA provides a discussion of the magnitude of the impacts within the context of the situation for each impact topic.

Table 2. Summary of Environmental Consequences

Resource	Alternative A No Action Alternative	Alternative B Emphasize Biological Resources Alternative	Alternative C Preferred Alternative	Alternative D Emphasize Visitor Services Alternative
PHYSICAL ENVIRONMENT				
Soils	Minor impact	Same as Alternative A	Same as Alternative A	Moderate negative impact due to increased public use
Hydrology	Minor impact	Moderate negative impact relative to Alternative A	Moderate positive impact relative to Alternative A	Same as Alternative A
Agricultural Resources	Minor impact	Same as Alternative A	Same as Alternative A	Same as Alternative A
Water Quality and Contaminants	Minor impact, positive impact from wetland filtering	Moderate positive impact relative to Alternative A	Same as Alternative A	Same as Alternative A
Air Quality	Long-term minor impacts, localized	Same as Alternative A	Same as Alternative A	Moderate impact relative to Alternative A
Noise	Minor impact	Same as Alternative A	Moderate impact relative to Alternative A	Moderate impact relative to Alternative A
BIOLOGICAL ENVIRONMENT				
Vegetation	Positive impact on vegetation from habitat management	Additional positive impact on vegetation from increased habitat management	Same as Alternative B	Moderate negative impact due to increased public use
Wildlife Resources	Positive impact on wildlife from habitat management	Additional positive impact on wildlife from increased habitat management	Same as Alternative B	Moderate negative impact due to increased wildlife disturbance
Fishery Resources	Minor impact	Same as Alternative A	Same as Alternative A	Same as Alternative A
Threatened and Endangered Species	Positive impact on species from habitat management	Additional positive impact on species from increased habitat management	Same as Alternative B	Moderate negative impact due to increased wildlife disturbance
SOCIAL AND ECONOMIC ENVIRONMENT				
Refuge Visitors	Positive impact from visitor services program	Minor negative impact: reduced public use opportunities	Additional positive impact by expanding public use opportunities	Positive impact: maximum public use opportunities

Resource	Alternative A No Action Alternative	Alternative B Emphasize Biological Resources Alternative	Alternative C Preferred Alternative	Alternative D Emphasize Visitor Services Alternative
Economy	Existing conditions, minor positive local impact	Same as Alternative A	Potential minor positive impact to local economy from increased public use opportunities	Potential moderate positive impact to local economy from increased public use opportunities
Cultural Resources	Minor impact, minimized through cultural resource reviews and surveys	Same as Alternative A	Same as Alternative A	Same as Alternative A
Climate Change	Minor impact	Same as Alternative A	Same as Alternative A	Same as Alternative A
Environmental Justice	No minority or low income populations will be disproportionately impacted	Same as Alternative A	Same as Alternative A	Same as Alternative A

Effects on the Physical Environment

Topics addressed under the physical environment section include direct and indirect effects to geology, soils, agricultural resources, air quality, noise, hydrology, and water quality. Cumulative impacts to the physical environment, addressed in the Cumulative Impacts section would result when the incremental impact of an action is added to other, closely related past, present, or reasonably foreseeable future actions.

Soils

Common to all Alternatives

Standard habitat management activities may have some effects on soils, including mowing, disking, tilling, herbicide/pesticide application, prescribed fire, grazing, and irrigation. Some of these activities may involve soil disturbance and may temporarily increase erosion and sedimentation rates in the project area. These increases are expected to be minor and localized; therefore, they are not expected to be significant.

Service-approved herbicides would be used with all alternatives. The use of Environmental Protection Agency (EPA) and California EPA labeled herbicides and pesticides is further regulated through the Service's Pesticide Use Proposal (PUP) process. This approach notes environmental hazards, efficacy, costs, and vulnerability of the pest. In addition, the Refuges' integrated pest management process results in minimizing the use of herbicide/pesticides and subsequently, leads to minor effects on soils.

Under all alternatives, the Service has concluded that authorized visitor service activities will have no significant impact to soils.

Alternative A

A minor impact to soils will occur under Alternative A; however, no significant changes to soils or sediments are anticipated as a result of the continuation of current management actions.

Alternative B

A minor impact to soils will occur under Alternative B. This alternative increases the amount of acres implemented annually under the HMP, IPM Plan, and Fire Management Plan. This alternative reduces the amount of visitor services provided on the Refuges. These changes are not expected to have any significant impacts on soils.

Alternatives C and D

Alternatives C and D increase the amount of acres implemented annually under the HMP, IPM Plan, and Fire Management Plan. In addition, the amount of visitor service opportunities increases (Alternative D would have more than Alternative C). As a result, a temporary increase in erosion and sedimentation is expected to be moderate. These increases, however, are not expected to be significant.

Hydrology

Common to all Alternatives

Habitat management activities would occur in all alternatives, but would have minor impacts on hydrology. Implementation of these activities would maintain the current hydrologic conditions within the Refuges. The Service has concluded that authorized visitor service activities will also have no significant impact to hydrology. The majority of these uses are confined to exiting roads and trails.

Alternatives A and D

Implementation of the no action alternative (Alternative A) and Alternative D would maintain the current hydrologic conditions within the Refuges (minor impact) and therefore have no significant impacts.

Alternative B

Under Alternative B, reduction of tree control efforts in the Sutter Bypass may lead to an increase in flood height and intensity at Sutter Refuge. This would be a moderate negative impact compared to Alternative A.

Alternatives C

Alternative C is also expected to improve the current hydrologic conditions (moderate positive impact), if best management practices for tree/shrub removal in the Sutter Bypass and Tree Reduction Operations Plan are implemented. No significant impacts are expected to occur.

Mitigation Measure 1: Implement Best Management Practices (BMPs) to Avoid Reduction in Floodwater Carrying Capacity in Sutter Bypass. The focus of the tree/shrub removal efforts will be within the center “alley” of the Sutter Refuge. Groups of trees with east-west orientation will be considered the highest priority for removal, but the trees bordering the east and west borrow canals would remain. This effort will be conducted in cooperation with the Department of Water Resources (DWR), Sutter County, and other interested parties.

BMPs include:

- Work cooperatively with DWR to spray herbicide on re-growth of selected woody vegetation.
- Within wetland management units, target saplings when disking and use herbicide and/or mechanical removal to control mid-sized trees (trees established after the 2001 tree removal effort).
- Control new woody growth (established after the 2005 removal work) via chemical and mechanical treatment within Tract 1 between the northwest grove and the road to the northeast gate.
- Selectively remove dense undergrowth within the northwest grove, primarily targeting Himalaya blackberry. In addition, selectively thin or prune trees to improve flowage as needed.
- Remove all non-native trees throughout the Refuge.

Agricultural Resources

Alternative A

A minor impact to agricultural resources will occur under Alternative A. No significant changes to agricultural resources are anticipated as a result of continuing current management actions and visitor services.

Alternatives B, C, and D

A minor impact to agricultural resources will occur under Alternative B, C, and D. Management actions include consideration of crop depredation issues, especially rice acres, in the Sacramento Valley. Given the current low frequency of crop depredation complaints in the local area, changes that would occur as a result of implementation of Alternatives B, C, or D are not expected to be significant.

Water Quality/Contaminants

Common to all Alternatives

All alternatives would have a minor positive impact from wetland filtering. Water quality is improved by wetland filtering, which removes organic and inorganic nutrients and toxic materials from the water that flows through them.

The control of invasive plant species would continue to be implemented on the Refuges. Control would involve the periodic application of herbicides. The use of herbicides poses several environmental risks. However, the potential for such risks are considered minimal due to the types and limited quantities of herbicides used and the precautionary measures taken during application. All herbicides are approved through the Service's PUP process.

Habitat management activities involve large earthmoving equipment that could result in the introduction of various contaminants, such as fuel oils, grease, and other petroleum products, either directly from equipment or through surface runoff. Contaminants may be toxic to fish or adversely affect their respiration and feeding. With the implementation of avoidance measures described below, no adverse effects on fish are expected to occur.

Mitigation Measure 2: Implement Best Management Practices (BMPs) to Avoid Reduction in Water Quality. BMPs could include a variety of sediment control measures, such as silt fences, straw or rice bale barriers, brush or rock filters, sediment traps, fiber rolls, or

other similar linear barriers that can be placed at the edge of the project area to prevent sediment from flowing off-site. The need for and appropriate type, location and placement of the various sediment control BMPs would be determined by the refuge manager.

The Refuges have established spill-prevention, control and countermeasure plans. These plans include on-site handling criteria to avoid input of contaminants to the waterway. Staging, washing, and storage areas are provided away from waterways for equipment, construction materials, fuels, lubricants, solvents, and other possible contaminants.

Lead poisoning has been a chronic and significant cause of migratory bird (primarily waterfowl) mortality associated with hunting in some areas of North America. Birds ingest spent lead shotgun pellets. The pellets are ground in their gizzards, converted to soluble form, and absorbed into tissues, which can have lethal effects. Secondary poisoning of predatory birds can also occur when they feed on birds carrying lead pellets embedded in body tissues (USDI 1988). The Service has mandated the use of nontoxic shot for all waterfowl hunting (50 CFR 20.21). In addition, the use of nontoxic shot is required for hunting pheasants, coots, moorhens, and snipe on the Sacramento, Delevan, Colusa, and Sutter Refuges.

Alternative A

No significant changes to water quality/contaminants are anticipated as a result of the continuation of current management actions.

Alternative B

Alternative B increases the amount of acres implemented annually under the HMP, IPM Plan and Fire Management Plan. Relative to all alternatives, the overall water quality and invertebrate prey abundance would improve with the elimination of active chemical mosquito control and will provide a moderate positive impact compared to Alternative A. This change is not expected to have significant impact on water quality/contaminants.

This alternative reduces the amount of visitor service opportunities provided on the Refuges. This change is not expected to have any significant impacts on water quality/contaminants, and would have a minor positive impact overall.

Alternatives C and D

Alternatives C and D increase the amount of acres implemented annually under the HMP, IPM Plan and Fire Management Plan. Relative to Alternative A, the overall water quality and invertebrate prey abundance under Alternatives C and D would improve with decreased use of pesticides for adult mosquito control. This change is not expected to have significant impact on water quality/contaminants.

In addition, the amount of visitor service opportunities increases under these alternatives (Alternative D would have more than Alternative C). These increases in visitor services, however, are not expected to have significant impacts on water quality/contaminants.

Air Quality

Common to all Alternatives

All alternatives would use limited prescribed fire to control non-native weeds, which may temporarily impact air quality. Burning vegetation could temporarily and substantially increase

particulate matter (PM10 or dust) concentrations in the area. However, adverse impacts from prescribed fire under all alternatives are expected to be less than significant for the following reasons: 1) prior to conducting a burn, the Service would develop a prescribed burn plan and obtain a burn permit from the appropriate Air Quality Management District; 2) the Service would follow all conditions of the permit; 3) measures to avoid and/or minimize adverse effects would include: close coordination with the appropriate Air Quality Management District; selection of a proper burn prescription and cessation of burn activities when conditions exceed predetermined prescription levels; and the use of firebreaks (cut line, existing roads) around burn units to minimize any potential for wildfire; and 4) prescribed fire impacts are mitigated by small burn unit size, direction of winds, and distance from population centers. See the Fire Management Plan for more detailed information (Appendix J). Interpretive programs, explaining the prescribed burning program, will also be conducted on and off the Refuges.

Alternative A

Under Alternative A, other factors that could affect air quality, such as visitor-related traffic generation and minor dust from habitat management work, would remain the same (minor localized impact).

Alternatives B

Alternative B will increase the number of acres burned, using prescribed fire, relative to Alternative A. Under Alternative B, minor amounts of short and long-term increases in pollutant emissions are expected. Short-term increases in dust (PM10) and tailpipe emissions (particulate matter, nitrogen oxides, and reactive gases) would result from increased habitat management projects that disturb the soil and/or require the use of heavy equipment. Tailpipe emissions would result from the use of combustion engines in construction equipment. Tailpipe emissions from visitors' vehicles would be reduced under this alternative. The minor emission increases caused by Refuge activities in implementing any of the Alternative B would not be considered significant.

Alternative C

Alternative C will also increase the number of acres burned, using prescribed fire, relative to Alternative A. Under Alternative C, minor amounts of short and long-term increases in pollutant emissions are expected. Short-term increases in dust (PM10) and tailpipe emissions (particulate matter, nitrogen oxides, and reactive gases) would result from increased habitat management projects that disturb the soil and/or require the use of heavy equipment. Visitor service activities will also increase under this alternative. Tailpipe emissions would result from the use of combustion engines in construction equipment and visitor vehicles. The minor emission increases caused by increased Refuge activities and visitor activities (including hunting) would not be considered significant.

Alternative D

Alternative D will also increase the number of acres burned, using prescribed fire, relative to Alternative A. Under Alternative D, minor amounts of short and long-term increases in pollutant emissions are expected. Short-term increases in dust (PM10) and tailpipe emissions (particulate matter, nitrogen oxides, and reactive gases) would result from increased habitat management projects that disturb the soil and/or require the use of heavy equipment. Tailpipe emissions would result from the use of combustion engines in construction equipment and visitor vehicles. Alternative D will have a moderate impact relative to Alternative A due to the long-term increases in emissions that would result from the growing number of vehicular trips to, from, and on the

Refuges as visitation increases. The minor emission increases caused by visitor activities (including hunting) would not be considered significant.

Noise

Alternative A

There is a minor impact on noise under Alternative A. The continuation of current activities on the Refuges would not generate noise of sufficient volume to impact any existing or future sensitive receptors in the general vicinity. No significant adverse noise impacts are anticipated as a result of Alternative A.

Alternatives B, C, and D

The implementation of the increased habitat management and visitor services activities proposed under Alternatives B, C, and D could potentially increase noise levels at certain times over a short duration on the Refuges (moderate impact relative to Alternative A). However, their implementation would not result in any significant increases in the current noise levels generated; therefore, no adverse effects related to noise are anticipated.

Effects on the Biological Environment

The effects to Refuges' habitats and vegetation as a result of implementing the various alternatives are described below. Potential impacts to these resources are characterized by evaluating direct, indirect, and cumulative effects. Direct impacts would involve the removal of vegetation as a result of ground-disturbing actions, while indirect impacts would involve changes to habitat or vegetation that are incidental to the implementation of an action. Cumulative impacts to habitat and vegetation resources, described in the Cumulative Impacts section, would result when the incremental impact of an action is added to other, closely related past, present, or reasonably foreseeable future actions.

Vegetation

Common to all Alternatives

Herbicides would be used under an IPM process for invasive species and weed management. Trained applicators would apply herbicides following manufacturers' recommendations and in accordance with approved PUPs. Use of herbicides would have a positive effect on vegetation, since the control of non-native or invasive species would result in an increase in native species, with minimal environmental cost. Alternatives B, C, and D would treat more acres annually relative to Alternative A.

Impacts to the Refuges' vegetation which result from visitor service activities are expected to be minimal. The locations of trails and other facilities will be selected to avoid significant effects to vegetation. Impacts to the Refuges' vegetation by hunters are expected to be minimal and insignificant. Hunting is conducted by foot by individuals or small groups, often accompanied by a hunting dog. This direct impact of foot travel by hunters on the habitat is often different from that of other wildlife-dependent recreation users because hunters tend to travel in dispersed patterns over wide areas, minimizing the chances of negatively impacting sites.

Alternative A

Under Alternative A, no changes would occur to the habitat management activities currently being conducted on the Refuges. The Service would continue to use burning, mowing, disking, irrigation, grazing, or herbicides to have positive impacts upon vegetation. Visitor services would

also continue as they have in the recent past. As such, no significant adverse or new beneficial effects to the existing habitats on the Refuges would result from the implementation of this alternative.

Alternative B

By fully implementing the HMPs and the IPM Plan in Alternative B, beneficial long-term impacts to vegetation on the Refuges are expected. Special-status plants and sensitive natural communities would benefit from reduced competition from non-native species. Habitat management and restoration fulfills the Service's congressional mandate to preserve, restore, and enhance habitat for threatened and endangered species, songbirds, waterfowl, other migratory birds, resident wildlife, and plants. No significant adverse impacts are expected.

Alternative B would decrease the amount of wildlife-dependent recreation offered on the Refuges and would result in the least impact to vegetation by visitor services relative to all the other alternatives.

Alternatives C and D

Alternatives C and D increase the amount of summer wetlands from 10 to 15 percent to 10 to 20 percent and 15 to 20 percent, respectively. This could lead to a potential 5 to 10 percent decrease in wetlands managed as seasonal wetlands which would result in a proportional decrease in productivity of those acres for wintering waterfowl, shorebirds, and other species. In addition, as a result of increased summer wetlands and supporting water conveyance canals, there would likely be an associated expansion of water primrose and other aquatic invasive species, which would create an additional need for their control.

By fully implementing the HMPs and the IPM Plan in Alternatives C and D, beneficial long-term impacts to vegetation on the Refuges are expected. Special-status plants and sensitive natural communities would benefit from reduced competition from non-native species. Habitat management and restoration fulfills the Service's congressional mandate to preserve, restore, and enhance habitat for threatened and endangered species, songbirds, waterfowl, other migratory birds, resident wildlife, and plants. No significant adverse impacts are expected.

Alternatives C and D would have minor impacts on some vegetated areas due to increased visitor services. Areas with special-status plants and sensitive natural communities would be avoided during the placement of any visitor service facilities. Alternative D will have a greater impact than Alternative C due to the additional visitors and the additional areas that would be opened to wildlife-dependant and compatible non-wildlife dependent recreation opportunities. No significant impacts are expected to occur.

Wildlife Resources

Common to all Alternatives

All alternatives would result in some short-term and long-term benefits for wildlife resources. Alternatives B, C, and D fully implement annual HMPs by enhancing and restoring Refuge lands and expanding the number and frequency of species being monitored. The increase in management and monitoring in these alternatives should provide additional benefits to wildlife resources compared to Alternative A. No significant impacts are expected for any of the alternatives.

Alternative A

Under Alternative A, current management of the Refuges would continue unchanged. The Refuges would continue to provide high quality habitat for migratory waterfowl, shorebirds, and other waterbirds through intensive habitat management activities. Other wildlife species would also benefit from the current management plan, including raptors, songbirds, and other migratory and resident wildlife. The Refuges' visitor services program would also continue unchanged. Overall there will be a positive effect on wildlife from the current habitat management plan.

Alternative B

Under Alternative B, habitat management will be maximized to provide the greatest level of benefit to waterfowl, other wetland-dependent birds, and other migratory birds. Food and cover production, water quality, and overall habitat availability based on annual abundance and migratory patterns will be optimized. Invasive species will be controlled to the greatest extent possible by fully implementing annual HMPs. Relative to Alternative A, the number and frequency of surveys would be increased to monitor a more comprehensive list of migratory bird species and the habitat upon which they depend. Examples would include a greater level of monitoring for the abundance/distribution of waterfowl, shorebirds, secretive waterbirds, raptors, Neotropical migrants, vegetation in all habitat types, aquatic and terrestrial insects, and other species or habitat communities. This will allow for more detailed information to further refine and improve management of the Refuges.

Alternative B would decrease the amount of wildlife-dependant recreation offered on the Refuges; therefore, we would expect a decreased amount of wildlife disturbance in this alternative. Overall, this alternative will have additional positive impacts on wildlife compared to Alternative A.

Alternative C

Alternative C balances all of the compatible priority public uses that occur on the Refuges with the mission of the Service and the purposes of the Refuges, and it is also consistent with the Improvement Act. Sensitive areas for wildlife, plants and cultural resources have been set aside as sanctuaries (11,117 acres) and are closed to the public. The remaining 12,856 acres of the Refuges allow carefully planned wildlife-dependent public uses. Compatible locations of trails and facilities, including restrooms and parking lots, would be chosen to minimize disturbance to wildlife. Areas outside of the trails and facilities are not expected to receive as much visitation or as concentrated visitation. To alleviate any negative effects, areas that are known to have sensitive species would have restricted public access and may have temporary closures to protect species during critical lifecycle periods such as nesting. Increased public education, trails, and signage and law enforcement will help to alleviate the degree of disturbance.

Compared to Alternatives A and B, there would be a potential decrease in habitat quality for wintering waterfowl as additional seasonal wetlands were converted to summer wetlands (increase from 10-15 percent to 10-20 percent).

The increase in visitor service opportunities in Alternative C is expected to occur within the wildlife observation and photography programs on the auto tour routes, trails, photography blinds, in areas currently opened to public use, and areas that are currently not opened to the public. Alternative C opens portions of the hunt areas on Sacramento, Colusa, and Sutter Refuges for wildlife observation and photography from February through June. Unlike Alternative D, this alternative does not open Delevan Refuge, core wildlife use areas, or areas containing sensitive

species.

Increased facilities and visitation would cause some degradation of habitat, displacement of wildlife, and increase the disturbance of some wildlife. Alternative C also increases the amount of species being hunted (spring turkey hunting), which may impact wildlife resources. However, this is expected to be minor given the size of the Refuges and the use of management strategies that avoid or minimize intrusion into priority wildlife habitat.

Alternative C provides a balance of benefits for wildlife resources and opportunities for public use activities. Compared to Alternative A, this alternative will result in additional positive impacts to wildlife from the increased habitat management. No significant impacts on wildlife resources are expected to occur under Alternative C.

Alternative D

This alternative would provide maximum reproduction habitat for waterfowl, tricolored blackbirds, white-faced ibis, and other summer wetland-dependent birds, relative to the other alternatives. There would be a potential decrease in habitat quality for wintering waterfowl as additional seasonal wetlands were converted to summer wetlands relative to the other alternatives (increase from 10-15 percent to 10-20 percent).

The increase in public use in Alternative D is expected to occur within the wildlife observation and photography programs on the auto tour routes and trails, in photography blinds, in areas currently opened to public use, as well as in areas that are currently not opened to the public. Alternative D opens the entire hunt areas on Sacramento, Colusa, and Sutter Refuges, and a portion of the hunt area on Delevan Refuge, from February through June. Alternative D would have a greater impact on wildlife resources than Alternatives A, B, and C because it allows for even more public access, including hunting of additional species (dove and spring and fall turkey hunting), hunting in additional areas of the Refuges, and access into the hunt areas for a longer period of time. It also allows compatible non-wildlife dependant recreation on the Refuges.

Alternative D more than doubles the amount of visitation that the Refuges currently support. The additional wildlife-dependant recreation opportunities offered in this alternative do not avoid or minimize intrusion into core wildlife use areas or areas containing sensitive species. This amount of public use is expected to have a moderate negative impact on the Refuges' resources. Increased facilities and visitation would cause some degradation of habitat, displacement of wildlife, and increased disturbance of some wildlife. These impacts however, are not expected to be significant.

Anticipated Direct and Indirect Impacts of Hunting on Wildlife Species

Hunting would occur in each of the proposed alternatives. Alternative A would continue the existing hunt program; therefore, harvest levels are expected to remain similar to previous years. Alternative B, which reduces hunting opportunities, would have slightly lower harvest levels than Alternative A. Alternative C could potentially increase harvest levels if turkey hunting is implemented. Alternative D, which increases hunting opportunities, would have slightly higher harvest levels than in all other Alternatives. Hunting is an appropriate wildlife management tool that can be used to manage wildlife populations. Some wildlife disturbance will occur during the hunting seasons. Proper zoning and regulations will be designated to minimize any negative impacts to wildlife populations and other public visitors using the Refuges.

Direct effects of hunting include mortality, wounding, and disturbance (De Long 2002). Hunting can alter behavior (i.e. foraging time), population structure, and distribution patterns of wildlife (Owens 1977, Raveling 1979, White-Robinson 1982, Thomas 1983, Bartelt 1987, Madsen 1985, and Cole and Knight 1990). There also appears to be an inverse relationship between the numbers of birds using an area and hunting intensity (DeLong 2002). In Connecticut, lesser scaup were observed to forage less in areas that were heavily hunted (Cronan 1957). In California, the numbers of northern pintails on Sacramento Refuge non-hunt areas increased after the first week of hunting and remained high until the season was over in early January (Heitmeyer and Raveling 1988). Following the close of hunting season, ducks generally increased their use of the hunt area; however, use was lower than before the hunting season began. Human disturbance associated with hunting includes loud noises and rapid movements, such as those produced by shotguns and boats powered by outboard motors. This disturbance, especially when repeated over a period of time, compels waterfowl to change food habits, feed only at night, lose weight, or desert feeding areas (Madsen 1995, Wolder 1993).

These impacts can be reduced by the presence of adjacent sanctuary areas where hunting does not occur and birds can feed and rest relatively undisturbed. Sanctuaries, or non-hunt areas, have been identified as the most common solution to disturbance problems caused from hunting (Havera et al. 1992). Prolonged and extensive disturbances may cause large numbers of waterfowl to leave disturbed areas and migrate elsewhere (Madsen 1995, Paulus 1984). In Denmark, hunting disturbance effects were experimentally tested by establishing two sanctuaries (Madsen 1995). Over a 5-year period, these sanctuaries became two of the most important staging areas for coastal waterfowl. Numbers of dabbling ducks and geese increased 4 to 20 fold within the sanctuary (Madsen 1995). Thus, sanctuary and non-hunt areas are very important to minimize disturbance to waterfowl populations to ensure their continued use of the Refuges.

Intermittent hunting can be a means of minimizing disturbance, especially if rest periods in between hunting events are weeks rather than days (Fox and Madsen 1997). It is common for Refuges to manage hunt programs with non-hunt days. At Sacramento Refuge, 3 to 16 percent of pintails were located on hunted units during non-hunt days, but were almost entirely absent in those same units on hunt days (Wolder 1993). In addition, northern pintails, American wigeon, and northern shovelers decreased time spent feeding on days when hunting occurred on public shooting areas, as compared to non-hunt days (Heitmeyer and Raveling 1988). The intermittent hunting program of three hunt days per week at Sacramento Refuge results in lower pintail densities on hunt areas during non-hunt days than non-hunt areas (Wolder 1993). However, intermittent hunting may not always greatly reduce hunting impacts.

The California Department of Fish and Game (CDFG) is California's lead agency for management of fish, wildlife, and native plants - collectively called "wildlife." CDFG has trustee responsibility for the conservation and management of wildlife for the benefit and enjoyment of the public.

Resident game species are protected on refuges by both Federal and State laws and regulations to ensure that harvest rates do not negatively impact populations. The potential impacts of hunting on resident upland game birds are discussed and evaluated in the California Environmental Quality Act process. This process results in periodically updated and publicly reviewed documents. Based on the findings of these documents, the State insures that game animal hunting in California does not adversely impact its wildlife populations to an unacceptable level (CDFG 2001, 2004a). Table 3 contains a summary of hunting seasons and bag limits for 2006-2007 for the

game species on the Sacramento, Delevan, Colusa, and Sutter Refuges.

Table 3. Sacramento, Delevan, Colusa, and Sutter Refuges, Hunting Season Bag Limit Summary for 2006-2007.

Species	Dates	Daily Bag Limits
Waterfowl – Ducks	Third Saturday in October extending for 100 consecutive days	Up to 7 ducks; see below; possession double the bag limit*
Waterfowl – Geese	October - concurrent with duck season	Up to 4 geese any species; possession double the bag limit
American Coot and Common Moorhen	October - concurrent with duck season	25/day, 25 in possession, either all of one species or a mixture of these species
Snipe	Third Saturday in October extending for 107 days	8/day; possession double the bag limit
Pheasants – General	Second Saturday in November extending for 44 days	2 – males first two days; 3 males thereafter; possession double the bag limit

*Duck Bag Limits: 7 ducks/ but not more than 2 hen mallards, 1 pintail, 1 canvasback, 2 redhead, 3 scaup, throughout the season

Wildlife populations on the Refuges are able to sustain hunting and also support other wildlife-dependent priority uses. To manage the populations to support hunting, the Refuges adopt harvest regulations set by the State within Federal framework guidelines. The regulatory procedures that govern harvest are described in the section below.

By its very nature, hunting has very few positive effects on the target species while the activity is occurring. However, in our opinion, hunting 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. Furthermore, despite the potential impacts of hunting, a goal of the Sacramento, Delevan, Colusa, and Sutter Refuges is to provide visitors of all ages an opportunity to enjoy wildlife-dependent recreation. Of key concern is to offer a safe and quality program and ensure adverse impacts remain at an acceptable level.

Recreational hunting will remove individual animals, but does not negatively affect wildlife populations. To assure that populations are sustainable, the California Fish and Game Commission, in consultation with the CDFG, annually review the population censuses to establish season lengths and harvest levels. Each year the refuge staff conducts habitat management reviews of each unit on the Complex to evaluate wildlife population levels, habitat conditions, and visitor service activities. The areas on the Refuges closed to hunting activities provide adequate sanctuaries for wildlife.

Harvest Management – Regulatory Procedures

Waterfowl populations throughout the United States are managed through an administrative process known as flyways, of which there are four (Pacific, Central, Mississippi and Atlantic). The review of the policies, processes and procedures for waterfowl hunting are covered in the following

documents.

NEPA considerations by the Service for hunted migratory game bird species are addressed by the programmatic document, "Final Supplemental Environmental Impact Statement: Issuance of Annual Regulations Permitting the Sport Hunting of Migratory Birds (FSES 88-14)," filed with the Environmental Protection Agency on June 9, 1988. The Service published a Notice of Availability in the Federal Register on June 16, 1988 (53 FR 22582) and the Record of Decision on August 18, 1988 (53 FR 31341). Annual NEPA considerations for waterfowl hunting frameworks are covered under a separate EA and FONSI. Further, in a notice published in the September 8, 2005, Federal Register (70 FR 53776); the Service announced its intent to develop a new Supplemental EIS for the migratory bird hunting program. Public scoping meetings were held in the spring of 2006, as announced in a March 9, 2006, Federal Register notice (71 FR 12216).

Because the Migratory Bird Treaty Act stipulates that all hunting seasons for migratory game birds are closed unless specifically opened by the Secretary of the Interior, the Service annually promulgates regulations (50 CFR Part 20) establishing the Migratory Bird Hunting Frameworks. The frameworks are essentially permissive in that hunting of migratory birds would not be permitted without them. Thus, in effect, Federal annual regulations both allow and limit the hunting of migratory birds.

The Migratory Bird Hunting Frameworks provide season dates, bag limits, and other options for the States to select that should result in the level of harvest determined to be appropriate based upon Service-prepared annual biological assessments detailing the status of migratory game bird populations. In North America, the process for establishing waterfowl hunting regulations is conducted annually. In the United States, the process involves a number of scheduled meetings (Flyway Study Committees, Flyway Councils, Service Regulations Committee, etc.) in which information regarding the status of waterfowl populations and their habitats is presented to individuals within the agencies responsible for setting hunting regulations. In addition, public hearings are held and the proposed regulations are published in the Federal Register to allow public comment.

For waterfowl, these annual assessments include the Breeding Population and Habitat Survey, which is conducted throughout portions of the United States and Canada, and is used to establish a Waterfowl Population Status Report annually. In addition, the number of waterfowl hunters and resulting harvest are closely monitored through both the Harvest Information Program (HIP) and Parts Survey (Wing Bee). Since 1995, such information has been used to support the adaptive harvest management (AHM) process for setting duck-hunting regulations. Under AHM, a number of decision-making protocols render the choice (package) of pre-determined regulations (appropriate levels of harvest) which comprise the framework offered to the States that year. California's Fish and Game Commission then selects season dates, bag limits, shooting hours and other options from the Pacific Flyway package. Their selections can be more restrictive, but can not 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.

Waterfowl – Flyway Analysis

As a result of the recent regulations, the estimated average annual duck harvest for the Pacific Flyway is 2.5 million birds, which represents approximately 18 percent of the estimated average annual U.S. harvest of 14 million ducks (USFWS 2005b). The estimated average annual goose

harvest for the Pacific Flyway is 383,091, which represents 10.8 percent of the estimated annual U.S. harvest of over 3.5 million geese.

For comparison, in 2005, the breeding duck population estimate for those areas surveyed (California, Oregon, Nevada, Utah and Washington) in the Pacific Flyway was 1,097,276 birds, which was a 22.7 percent increase from the 2004 average (USFWS 2005b). The estimated average duck breeding population for these areas from 1994 to 2005 was approximately 1.10 million birds. Furthermore, by itself the 2007 Midwinter Waterfowl Survey Index for ducks wintering in California was approximately 4,000,000. These numbers serve to demonstrate the relative importance of these areas (especially California) in the Pacific Flyway for wintering waterfowl, rather than for waterfowl production. In fact, the vast majority of waterfowl wintering and subsequently harvested in California and throughout the Pacific Flyway come from breeding grounds to the north.

Waterfowl - Regional Analysis

The estimated breeding duck population in California in 2005 was 618,241 birds, which was a 49 percent increase from the 2004 estimate (USFWS 2005b). The average estimated breeding duck population for California from 1990 to 2005 was 605,263 birds. Mallards generally comprise more than half of each year's breeding population estimate. Add to that, an estimate of a few thousand breeding Western Canada Geese, and you have a pretty good picture of the magnitude of California's waterfowl reproduction on an annual basis. In contrast, the Mid-winter Waterfowl Survey index for California totals 4 million ducks and 1 million geese in recent years, further illustrating the relative importance of California's overall wintering waterfowl capacity within the Pacific Flyway.

Annual harvest estimates for California indicate that approximately 1.5 million ducks and 130,000 geese have been harvested by some 65,000 waterfowl hunters (based on Federal Duck Stamp sales) in recent years (USFWS 2005b).

Closer to home, for those counties in which the Refuges occur, the estimated duck harvest for Glenn, Colusa, and Sutter counties was 128,768, 370,091, and 121,182 respectively. The goose harvest was 18,127, 34,676, and 13,092 respectively (CDFG 2004b). The estimated number of duck hunters for these counties in 2004 was 5,270, 14,703, and 5,438 respectively. The estimated number of goose hunters was 4,331, 9,869, and 3,156 respectively. The harvest of coots and moorhens for Glenn, Colusa, and Sutter counties was 0, 1,443, and 2,014 respectively and the number of hunters was 0, 235, and 67 respectively.

Waterfowl - Local Analysis

Waterfowl harvest is tracked for Sacramento, Delevan, Colusa, and Sutter Refuges by collecting information at the Refuge check stations. In 2005 to 2006, 7,683 hunters at Sacramento Refuge harvested 16,871 birds (15,180 ducks, 1,575 geese, and 116 coots), with an average of 2.26 birds/hunter. For the same time period at Delevan Refuge, 6,386 hunters harvested 19,130 birds (17,432 ducks, 1,659 geese, and 39 coots) with an average of 3.04 birds/hunter; at Colusa Refuge, 3,910 hunters harvested 9,805 birds (9,240 ducks, 377 geese, and 188 coots) with an average of 2.60 birds/hunter; and at Sutter Refuge, 2,152 hunters harvested 4,157 birds (3,859 ducks, 292 geese, and 6 coots) with an average of 1.93 birds/hunter. In combination, these four Refuge hunt programs resulted in some 20,000 hunter visits harvesting nearly 46,000 ducks and 3,900 geese, which amounted to 23.7 percent of the ducks and 42.6 percent of the geese taken on all the CDFG

conducted public hunt areas (40) in California. Under Alternative A, effects of waterfowl harvest are expected to be similar to previous years. Harvest would be less under Alternative B, and slightly more under Alternatives C and D.

Sacramento, Delevan, Colusa, and Sutter Refuges consist of 23,126 acres of wetland, grassland, and riparian habitats. Seasonal wetlands comprise the majority of habitats allowing these Refuges to support peak populations of approximately 1,400,000 ducks and 550,000 geese.

Significance Conclusion for Waterfowl

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. As a result of the regulatory options produced (AHM) in recent years, California hunter's estimated harvest of nearly 1.5 million ducks is approximately 12 percent of the total U.S. harvest of 12.3 million and 55 percent of the Pacific Flyway's 2.65 million harvest estimates (USFWS 2005b). The comparative numbers for the estimated goose harvest yield percentages of 4.1 percent and 33 percent of the U.S. and Pacific Flyway totals, respectively. Furthermore, some forty CDFG administered public hunt areas allow take of approximately 12 to 15 percent and 7 percent of California's estimated duck and goose harvest, respectively. Of the forty CDFG administered hunts, the Sacramento, Delevan, Colusa and Sutter Refuges represent nearly 23 and 42 percent of all ducks and geese harvested, respectively. While these percentages may be noteworthy at the local level, they amount to only 3 percent of California's estimated duck harvest, only 1.7 percent of the Pacific Flyway estimate, and only 0.37 percent of the total U.S. duck harvest.

Based on this analysis, the Service has concluded that hunting associated with each of the alternatives will not have a significant impact on local, regional, or Pacific Flyway waterfowl populations.

Wilson's Snipe – Regional Analysis

Wilson's snipe, formally called common snipe, is particularly well camouflaged with a striped head and back, white belly, and rusty tail. They are usually only seen when flushed from the edge of a marsh or pond. In flight they are fast and erratic.

Wilson's snipe is found throughout the United States. The U.S. Shorebird Conservation Plan (Brown et al. 2001) population estimates for snipe are two million. They breed from northern Alaska and Canada south to the southwestern and northeastern United States and winter throughout much of the United States, all of Central America, the Caribbean, and northern South America. Snipe are fairly common from October to April on wet meadow and short, emergent wetland habitats throughout much of California (Figure 17). They are a year-round resident in parts of northeastern California (Airola 1980).

The 2004 Hunter Survey (CDFG 2004a) reported a statewide harvest of 6,882 snipe with 168, 973, 101 birds harvested in Glenn, Colusa and Sutter counties, respectively. During 2004, the number of snipe hunters statewide was 1,116 with 67, 269, and 34 hunters reported for Glenn, Colusa, and Sutter counties, respectively (CDFG 2004a).

Wilson's Snipe – Local Analysis

In 2005 to 2006, 23 snipe were harvested on Sacramento Refuge; 4 snipe were harvested on

Delevan Refuge; 2 snipe were harvested on Colusa Refuge; and 0 snipe were harvested on Sutter Refuge. In 2004 to 2005, the number of snipe harvested on the Refuges was 4, 4, 2, and 1, respectively.

Sacramento, Delevan, Colusa, and Sutter Refuges, consist of 23,126 acres of wetland, grassland, and riparian habitats. Seasonal wetlands comprise the majority of habitats on these Refuges.

Snipe harvest rates are not expected to change significantly over time under any of the alternatives.

Significance Conclusion for Wilson's snipe

Based on the Local Analysis, the Service has concluded that hunting associated with each of the alternatives will not have a significant impact on local populations or statewide populations of Wilson's snipe.

Ring-necked Pheasant - Regional Analysis

The ring-necked pheasant is native to eastern Asia. First attempts to introduce the species in California were made in the 1880s (CDFG 2004a). In 1925, pheasants became established in sufficient numbers for a hunting season, first held in Inyo and Mono counties.

The CDFG (2004a) objectives include maintaining healthy resident game bird populations including ring-necked pheasants and providing public hunting opportunities through regulated harvest. These objectives are consistent with the wildlife conservation policy adopted by the State Legislature in Section 1801 of the Fish and Game Code. The State's wildlife conservation policy, among other items, contains the objective of providing for the harvest of wildlife resources where such use is consistent with maintaining healthy wildlife populations.

Ring-necked pheasants are found in six habitat types in California consisting of 14,390,125 acres (Figure 18) (CDFG 2004a). Densities range between 0.66 and 12 acres per bird (Hart 1990, Hart et al. 1956). The size of the pheasant population (adults in the spring) is estimated to be at least 1,199,177 birds (CDFG 2004a). The Breeding Bird Survey Data for the Central Valley Region of California during the period of 1966 to 2002 shows a slightly increasing population trend.

The adult spring population of ring-necked pheasants includes about 58 percent females (Hart 1990). Nesting success is 53 percent, clutch size averages 12, and 83 percent of the eggs hatch (Schemnitz 1980). Brood mortality is 63 percent (Hill and Robertson 1988) and adult mortality (including hunting) is 63 percent (Peterson et al. 1988). Total annual mortality (natural) is estimated to be at least 3,068,542 from a pre-mortality population of at least 4,870,702 birds.

The five-year average annual harvest of 176,815, including unretrieved hunting mortality (CDFG 2002), represents about 6 percent of the total annual mortality. The 2004 Hunter Survey (CDFG 2004b) reported a statewide harvest of 132,996 ring-necked pheasants with 9,735, 21,551 and 7,385 birds harvested in Glenn, Colusa and Sutter counties, respectively. During 2004, the number of pheasant hunters statewide was 39,107 with 2,518, 5,405 and 2,048 hunters reported for Glenn, Colusa, and Sutter counties, respectively (CDFG 2004b).

Figure 17. Wilson's snipe range map.

(CDFG website 2007)

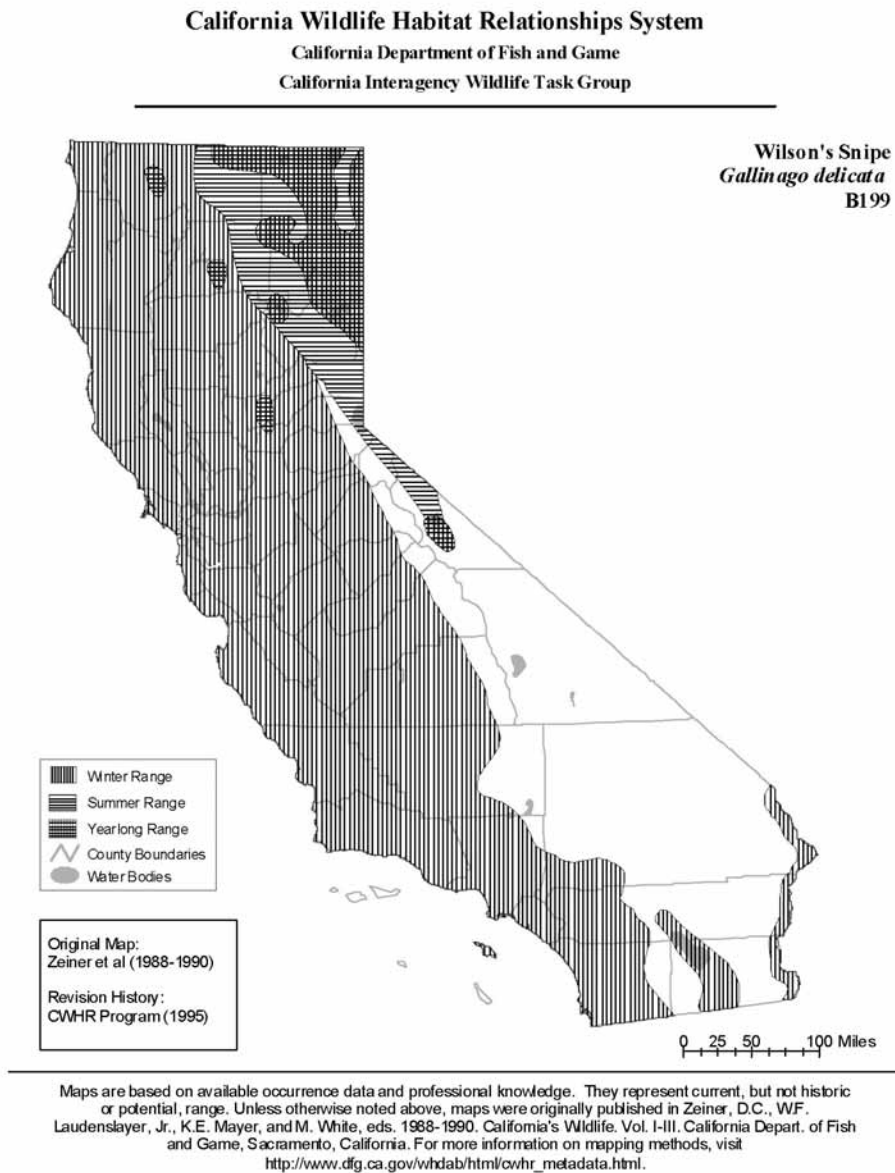
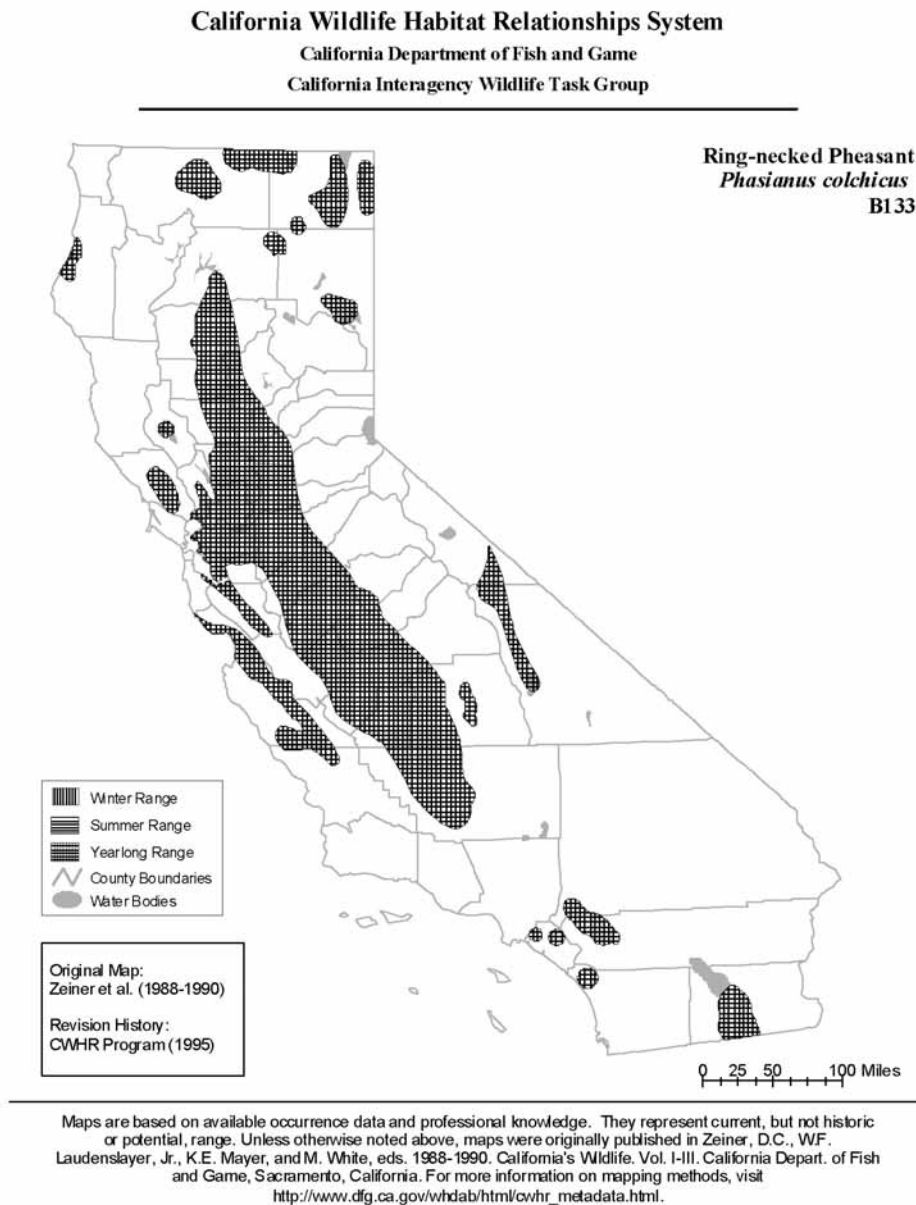


Figure 18. Ring-necked pheasant range map.
(CDFG website 2007)



Ring-necked Pheasant - Local Analysis

Pheasant surveys are conducted annually on the Refuges. At Sacramento Refuge in 2006, a total of 245 pheasants (4.6 chicks per mile) were observed on the 33 mile survey route. At Delevan Refuge a total of 93 pheasants (2.7 chicks per mile) were observed on the 24 mile route. At Colusa Refuge a total of 76 pheasants (2.3 chicks per mile) were observed on the 21 mile route. Although no survey is conducted at Sutter Refuge, pheasant populations are quite low due to the frequent winter flooding that occurs over the majority of the Refuge because of its location in the Sutter Bypass.

Pheasant harvest is tracked for Sacramento, Delevan, Colusa, and Sutter Refuges. In 2005, 233 pheasants were harvested on Sacramento Refuge (0.30 average pheasants/hunter); 184 pheasants were harvested on Delevan Refuge (0.11 average pheasants/hunter); 135 pheasants were harvested on Colusa Refuge (0.29 average pheasants/hunter); and 26 pheasants were harvested on Sutter Refuge (0.02 average pheasants/hunter). These harvest numbers can be compared with nearby State Wildlife Areas (WA). The Llano Seco Unit of Upper Butte Basin WA harvested 78 pheasants in 2005 (0.65 average pheasants/hunter); Howard Slough Unit of Upper Butte Basin WA harvested 257 pheasants (0.28 average pheasants/hunter); Little Dry Creek Unit of Upper Butte Basin WA harvested 520 pheasants (0.37 average pheasants/hunter); and Gray Lodge WA harvested 987 pheasants (0.24 average pheasants/hunter).

Sacramento, Delevan, Colusa, and Sutter Refuges, consist of 23,126 acres of wetland, grassland, and riparian habitats. Seasonal wetlands comprise the majority of habitats on these Refuges. Approximately 1,249 acres of annual and perennial grassland habitats provide the majority of the habitat supporting pheasants on the Refuges.

Pheasant harvest rates are not expected to change significantly over time under any of the alternatives.

Significance Conclusion for Ring-necked pheasant

The CDFG (2004a) determined that the removal of individual animals from resident game bird populations statewide will not significantly reduce those populations and therefore, not have a significant environmental impact on resident game birds. The CDFG (2004a) also determined that resident game bird hunting will not have a significant impact on other aspects of the natural environment. Current hunting regulations permit the harvest of only male pheasants; and because pheasants are polygynous (one male capable of breeding several females), there is very little effect on reproduction (Hart 1990). In addition, the CDFG (2004a) determined there are no significant adverse impacts to the ring-necked pheasant population expected as a result of existing hunting regulations.

Based on the Local Analysis, the Service has concluded that hunting associated with each of the alternatives will not have a significant impact on local populations or statewide populations of ring-necked pheasant.

Effects of Hunting on Other Non-hunted Wildlife Species

Hunted species and other wildlife will possibly compete for habitat. While each species occupies a unique niche, there is only a finite amount of space available to satisfy various habitat requirements of water, food, cover, breeding, roosting, and fawning areas. So, while individuals of a species compete for habitat within the species niche, most species occupy space to the exclusion of many other species. Hunted species (waterfowl, coot, common moorhen, pheasant, and snipe) generally do not prey on other species at unacceptable levels. Harvesting these species would not result in a substantial decrease in biological diversity on the Refuges.

Hunting is a highly regulated activity, and generally takes place at specific times and seasons (dawn, fall and winter) when the game animal is less vulnerable. Hunting is an appropriate wildlife management tool that can be used to manage game populations. Although, some wildlife disturbance to non-hunted wildlife will occur during the hunting seasons, proper zoning, regulations, and Refuge seasons will be designated to minimize any negative impacts to wildlife

populations using the Refuges.

Human disturbance associated with hunting includes loud noises and rapid movements, such as those produced by shotguns. This disturbance, especially when repeated over a period of time, may compel waterfowl to change food habits, feed only at night, lose weight, or desert feeding areas (Madsen 1995, Wolder 1993). Presumably these same behavioral changes may occur by non-hunted wildlife species as a result of hunting-related noises and movements.

These indirect impacts are not significant on the Refuges since they can be reduced by the availability of adjacent sanctuary areas where hunting does not occur, and both hunted and non-hunted wildlife can feed and rest relatively undisturbed. Sanctuaries or non-hunt areas have been identified as the most common solution to disturbance problems caused from hunting (Havera et al. 1992).

Biological conflicts (all alternatives) would be minimized by applying the following management practices (USFWS 2008b):

- Proper zoning and regulations will be designated to minimize negative impacts to wildlife.
- The number of hunters will be limited by designated hunter quotas at each of the Refuges.
- Check stations will process the hunters entry to and exit from the hunting area
- Federally approved non-toxic shot will be used for all hunting to help minimize the possibility of lead poisoning.
- No hunting will be allowed during the breeding season. Hunting will be allowed only during designated seasons for waterfowl and upland game birds.
- The hunting area is flooded-up beginning approximately 2 ½ months prior to hunting season to allow bird use
- The areas closed to hunting activities will provide adequate sanctuaries for wildlife.
- Law enforcement presence will help minimize excessive harvest and other infractions (illegal use of lead shot, take of non-game species, littering, etc.).
- Firearms are permitted on the Refuges for public hunting under the provisions of 50 CFR part 32. Persons may carry unloaded firearms on the Refuges that are dismantled or cased in vehicles (50 CFR 27.42).
- Section 7 consultations with USFWS and NOAA-Fisheries will be completed to determine effects of the CCP (USFWS 2008a) on special status species/designated critical habitat occurring on the Refuges.
- The Refuges will provide information in Refuge kiosks about preventing the spread of invasive terrestrial and aquatic plant species.

Fisheries Resources

Fish species occur at the Refuges throughout the water distribution system, which includes several creeks (Logan, Stone Corral, Hunter's), the Colusa Basin Drain, east and west Sutter Bypass canals, and many smaller water supply and drainage ditches. Most fish are non-native warm water resident species. Native anadromous fish include steelhead and four distinct runs of Chinook salmon. Three of the four Chinook salmon runs are considered unique Evolutionary Significant Units (ESU). These include the Sacramento River winter-run ESU, Central Valley spring-run ESU, and Central Valley fall-run and late-fall-run ESU Chinook salmon. The Central Valley ESU steelhead is also a unique race. Anadromous fish are migratory, using the open ocean, bays, estuaries, deltas, main river channels, floodplains, and tributaries. Anadromous fish spawn in freshwater environments and spend their adult life in marine environments.

During periods of high flows in the Sutter Bypass, Sutter Refuge can be used by large numbers of salmon and steelhead. Adult salmon and steelhead that spawn in Butte Creek pass through the Sutter Bypass in route to their spawning area in upper Butte Creek, while migrating juveniles pass through the Bypass in route to the Pacific Ocean. These fish typically pass through the Bypass during high water events within the east and west borrow channels, located adjacent to the Refuge. The Refuge maintains adequate flows of water through the wetland units within the Bypass for migrating juvenile salmonids during periods when these fish may be present.

Under Alternatives A and B, there would be a minor impact and fisheries resources would remain unchanged. Alternatives C and D also have minor impacts and would provide additional fish-supporting habitat in summer wetlands and their infrastructure. This could potentially result in more widespread carp distribution on the Refuges, but would be controlled with periodic rotation of wetland habitat types, as per the current practice. Under Alternative D, public fishing would remove an insignificant amount of fish at a few locations. No significant impacts to fisheries resources are expected under any of the alternatives.

Threatened and Endangered Species

Common to All Alternatives

It is the policy of the Service to protect and preserve all native species of fish, amphibians, reptiles, birds, mammals, invertebrates, and plants, including their habitats, which are designated threatened or endangered with extinction. The Service has listed a number of plant species as endangered, threatened, or rare, and a number of animal species as endangered or threatened which occur on the Refuges including: palmate-bracted bird's beak, hairy Orcutt grass, Greene's tuctoria, Hoover's spurge, Conservancy fairy shrimp, vernal pool fairy shrimp, vernal pool tadpole shrimp, giant garter snake, western yellow-billed cuckoo, winter-run Chinook salmon, spring-run Chinook salmon, Central Valley steelhead, fall-run Chinook salmon, and late fall-run Chinook salmon.

All alternatives would result in some short-term and long-term benefits for threatened and endangered (T&E) species; however, no significant impacts are expected under any of the alternatives.

A common concern among members of the public and wildlife professionals, including Service personnel, is the impact of damage management assistance methods and activities on non-target species, particularly threatened and endangered species. Section 7 of the Endangered Species Act (ESA), as amended (16 U.S.C. 1531-1543; 87 Stat. 884), provides that,

"The Secretary shall review other programs administered by him and utilize such programs in furtherance of the purposes of this Act" (and shall) "ensure that any action authorized, funded or carried out ... is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of (critical) habitat ..."

Section 7 consultations with USFWS and NOAA-Fisheries will be completed to determine effects of the CCP (USFWS 2008a), which included hunting of waterfowl, coot, common moorhen, pheasant, and snipe, on special status species/designated critical habitat occurring on the Refuges.

Giant garter snake (GGS)

All of the alternatives provide benefits for GGS. Alternatives B, C, or D would provide an increase in habitat availability for GGS as a result of the increase in summer wetlands (i.e. semi-permanent and permanent). Relative to the other alternatives, Alternative D would provide the largest potential percentage of summer wetlands (15 to 20 percent) and therefore the largest amount of GGS habitat.

All alternatives could also adversely affect the GGS if restoration or maintenance activities were to occur in potential GGS habitat. The following measures would be taken to protect GGS and its habitat when threatened by restoration activities:

Mitigation Measure 3: Avoid Giant Garter Snake Habitat by Restricting Location and Timing of Project Activities. As stated in the Service's Programmatic Section 7 (USFWS 1999), earth moving activities will be restricted to May through October, during the majority of the giant garter snake's active period when snakes are able to escape and avoid danger. During the giant garter snake's inactive period (November 1 through April 1) some small-scale emergency levee repair may occur, but will usually be less than 20 linear feet. The majority of earth moving activities will occur within wetlands that have been drained and allowed to dry for two weeks.

Alternative A

No significant changes to threatened or endangered species are anticipated as a result of the continuation of current management actions. Populations of T&E species are expected to remain stable or increase under this alternative.

Alternatives B and C

Increased management and monitoring in Alternatives B and C would provide additional benefits to T&E species. There would be an increased knowledge of the status and distribution of T&E species through increased inventory and assessment. Alternative B would ensure the least amount of disturbance to T&E species. By fully implementing the annual HMPs, competition from exotic and invasive species and physical disturbance would be minimized, and monitoring efforts would be maximized.

Increases in summer wetlands and activation of supporting water conveyance systems in Alternatives B and C would create some additional risk of affecting vernal pool plant and animal species due to unintentional flooding. This would also likely increase expansion of water primrose and other aquatic invasive species, which would create a need for additional control efforts.

Alternative D

Increased management and monitoring in Alternative D would provide additional benefits to T&E species. There would be an increased knowledge of the status and distribution of T&E species through increased inventory and assessment. By fully implementing the annual HMPs, competition from exotic and invasive species and physical disturbance would be minimized, and monitoring efforts would be maximized.

Increases in summer wetlands and activation of supporting water conveyance systems in Alternative D would create some additional risk of affecting vernal pool plant and animal species due to unintentional flooding. This would also likely increase expansion of water primrose and

other aquatic invasive species, which would create a need for additional control efforts. Alternative D would also have a moderate negative impact on listed species because of increased wildlife disturbance.

Alternative D more than doubles the amount of visitation that the Refuges currently support. The additional wildlife-dependant recreation opportunities offered in this alternative do not avoid or minimize intrusion into core wildlife use areas or areas containing sensitive species. This amount of public use is expected to have a negative impact on the Refuges' resources, including T&E species. Increased facilities and visitation would cause some degradation of habitat, displacement of wildlife, and increase disturbance to some wildlife. These impacts, however, are not expected to be significant.

Other Special Status Wildlife Species

All alternatives would result in short-term and long-term benefits for special status wildlife species due to restoration of habitats (See Appendix K for species list). Alternatives B, C, and D would provide more positive effects for the greatest number of special status wildlife species than Alternative A, since more habitats would be enhanced or restored. However, the beneficial short and long-term effects on wildlife would not be significant. The Refuges would only be able to provide habitat for a limited number of special status wildlife species. While this would be a benefit, it would probably not be enough to restore their populations. The Refuges' contribution, therefore, is only part of what may be required for the continued long-term survival of special status wildlife species.

Increases in summer wetlands and activation of supporting water conveyance systems in Alternatives B, C, and D would create some additional risk of affecting vernal pool plant and animal species due to unintentional flooding.

Alternative D more than doubles the amount of visitation that the Refuges currently support. The additional wildlife-dependant recreation opportunities offered in this alternative do not avoid or minimize intrusion into core wildlife use areas or areas containing sensitive species. This amount of public use is expected to have a moderate negative impact on the Refuges' resources, including special status species. Increased facilities and visitation would cause some degradation of habitat, displacement of wildlife, and increased disturbance to some wildlife.

However, the Service has concluded that management activities and authorized visitor service activities on the Refuges will have no significant impact to special status species under all the alternatives.

Effects on the Social and Economic Environment

This section discusses the direct and indirect economic effects on the regional economy of implementing the various alternatives presented for each Refuge. Economic or social changes resulting from an action are considered to produce significant effects if they result in a substantial adverse physical change in the environment (e.g., urban blight).

Visitor Services

Alternative A

Under Alternative A, the Service would maintain current Refuge visitor services and facilities. Wildlife-dependant recreation opportunities would continue at current levels, including hunting,

wildlife observation, photography, environmental education, interpretation, and volunteer activities.

Hunting is conducted on foot by individuals or small groups, often accompanied by a hunting dog. This direct impact of foot travel by hunters on the habitat is often different from that of other wildlife-dependent recreation users because hunters tend to travel in very dispersed patterns over wide areas, minimizing the chances of negatively impacting sites. This is in contrast to the tendency of many other wildlife-dependent recreation users who congregate on a limited number of trails. Hunting is not allowed on Refuge trails.

Minor impacts to Refuge roads in the hunt areas will occur from hunter use. The hunting parking areas will also receive normal wear and tear from hunters. These impacts are expected to be relatively minor.

Alternative B

Under Alternative B, the visitor service opportunities and facilities would be reduced to optimize wildlife and habitat management. In an effort to reduce disturbance, the wildlife observation programs and facilities would be reduced from 80,000 to 60,000 annual visits, auto tour routes would be limited to weekend use only, and buses and recreational vehicles (RVs) would be prohibited on the auto tour routes. The photography program would also be reduced. All photography blinds would be eliminated and photography would be limited to auto tour routes and walking trails only on Sacramento and Colusa Refuges. A Wetland Resource Center would be constructed and more teacher workshops would be held in an effort to “centralize education” and minimize disturbance impacts in habitats.

Under Alternative B, the hunting program would be reduced with increased closed zone acreage on Sacramento, Colusa, and Sutter Refuges, fewer hunt days, a hunter selection process by reservation only with no refills, only spaced blinds and/or assigned ponds on all Refuges, no pheasant hunting, and no overnight stays allowed.

The Improvement Act directs the Service to provide compatible wildlife-dependant recreational opportunities. However, Alternative B emphasizes wildlife resources and actually decreases the compatible wildlife-dependant recreational opportunities on the Refuges. Although this alternative would cause a minor negative impact on visitor services, no significant impacts on visitor services are expected.

Alternative C

Alternative C would improve and expand visitor services on the Refuges. A Wetland Resource Center would be constructed on Sacramento Refuge, hunting, wildlife observation, photography, environmental education and interpretation activities would increase, and the volunteer program would expand.

The wildlife observation and photography programs and facilities would be expanded from 80,000 to 100,000 annual visits. Viewing platforms at Delevan Refuge adjacent to Maxwell Road and along Four Mile Road would be constructed and a walking trail would be added to Sutter Refuge. Visitation time on the auto tours and trails would also be expanded to include one hour before sunrise and one hour after sunset. A universally accessible blind would be constructed to replace photo blind #2 on Sacramento Refuge, another universally accessible photography blind would be

constructed at Delevan Refuge, and use of the photo blinds during the spring and summer would be allowed when habitat conditions are suitable.

Portions of the hunt areas would be opened from February through June for wildlife observation and photography on Sacramento, Colusa, and Sutter Refuges. Opening the hunt areas will allow visitors to observe wildlife without being confined to the walking trails or to their cars on the auto tour routes. Seasonal parking areas and fee stations would need to be constructed.

Under Alternative C, the hunting program at Sutter Refuge would change to include a hunter selection process that uses a prioritized system via reservation first, then lottery, and then first-come, first served to be consistent with the hunter selection process on the other Refuges. In addition, a combination of free roam and assigned ponds would be offered on Sutter Refuge. Sacramento Refuge would convert some spaced blinds to assigned ponds. Colusa Refuge would convert some free roam area to assigned ponds. The pheasant only area on Colusa Refuge would also be converted to free roam. Limited spring turkey hunting opportunities could be allowed on Sacramento, Delevan, and Colusa Refuges.

Alternative C increases visitor service impacts on the Refuges compared to Alternatives A and B, but has fewer impacts than Alternative D. It provides the optimal balance of wildlife resources and visitor services; it also provides benefits, although not significant benefits, to both programs as well as to the 100,000 visitors that take advantage of the wildlife-dependant recreation opportunities. The overall increase in wildlife-dependent recreational opportunities in Alternative C is not significant. This alternative is viewed positively because it is compatible with the purposes of the Refuges, mission of the Service, the National Wildlife Refuge System, and it is also consistent with the Improvement Act.

Alternative D

Alternative D would provide additional visitor service facilities and activities. Currently, the Service could not implement this alternative and would require a considerable increase in funding and staffing for visitor services, biological monitoring, and law enforcement. The wildlife observation visits would expand from 80,000 to 200,000 annually; this would impact the carrying capacity of the visitor services facilities and programs, leading to a marked increase in wildlife disturbance and reducing the quality of the visitors' experience.

Additional turkey, pheasant, and dove hunting on all Refuges, as well as the addition of fishing on Sacramento and Colusa Refuges, would result in the need for more law enforcement officers to address the increased public use. Limited fishing opportunities were allowed in the past and were discontinued because of excessive vandalism, littering, and trespass into the closed areas of the Refuges. Opportunities for fishing and dove hunting are available on Sacramento River Refuge, other public lands, and on nearby private lands. Providing dove hunting opportunities and additional pheasant hunting opportunities may reduce the quality of other hunting opportunities on the Refuges.

Opening the entire hunt area during the spring on Sacramento, Colusa, and Sutter Refuges, and on a portion of Delevan Refuge, would increase wildlife disturbance (see Wildlife Resources, Threatened and Endangered Species and Other Special Status Wildlife Species sections above). Other than the number of acres, Alternative C offers the same wildlife observation and photography opportunities without impacting wildlife resources to the same extent as Alternative

D. Alternative D would also require construction of additional seasonal parking areas and fee stations.

The volunteer program would focus on visitor service projects and exclude needed wildlife habitat projects. Non-wildlife dependant recreation opportunities would be allowed where compatible, which would also increase the wildlife disturbance.

By further increasing visitor service opportunities, this alternative would have a positive effect on visitor services, although not considered to be significant. The Improvement Act directs the Service to provide compatible wildlife-dependant recreational opportunities. However, this alternative emphasizes visitor services over wildlife resources and therefore, may conflict with the purposes for which the Refuges were established.

Effects of Hunting on Other Refuge Wildlife-Dependant Recreation Common to All Alternatives

The Refuges would be open to wildlife-dependent recreation (hunting, wildlife observation, photography, environmental education, and interpretation). Areas of exclusive use for non-hunting wildlife-dependent recreation users would be provided under each alternative.

Hunting affects other wildlife-dependent recreation opportunities in a variety of ways. Many non-hunters plan their vacations or visits to avoid being in the “woods” during the hunting seasons. Most tend to seek out areas that offer amenities such as trails, parking areas, and information kiosks. These facilities provide bird watchers, photographers, and students an opportunity to experience the Refuges for a safe, informally guided visit.

In contrast, hunters plan their visits to correspond with the hunting seasons. They seek out the habitats that support the game species they are hunting. Most of the hunting occurs in fall and early winter.

Although the timing of wildlife observation, photography, environmental education and interpretation activities overlap with hunting activities, they occur in geographically distinct areas on the Refuges.

Conflicts between hunting and other public uses will be minimized by implementing the following management practices:

- Physically separate non-hunting and hunting acres to spatially divide the activities.
- Hunting will be limited to Wednesdays, Saturdays, and Sundays during the established seasons.
- Boundary and hunting area signs will be maintained to clearly define the designated hunting areas.
- Allow vehicle traffic only on designated roads and parking areas.
- Parking areas will be signed and gated to allow only pedestrian hunter access to hunting areas.
- The hunting program will be managed in strict accordance with all applicable Federal laws (Code of Federal Regulations, Title 50 subchapter C) and to the extent practicable, consistent with applicable State laws.
- Field checks by refuge law enforcement officers will be planned and coordinated with staff and

other agencies to maintain compliance with regulations and assess species and number harvested.

- Provide information about the refuge hunting program through signs, kiosks, brochures, and the Complex's website (<http://www.fws.gov/sacramentovalleyrefuges>).
- No camping or tents are allowed on the Refuges.
- Outreach plan will serve as a means for managing social conflicts.

By implementing these management practices there will be minimal conflicts between hunters and the other wildlife-dependent recreational uses. The uses are not occurring on the same area at the same time. Therefore, hunting will have minimal effects on other wildlife-dependent recreation opportunities.

Economy

Alternative A

The report "Banking on Nature 2006: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation" (USFWS 2007) detailed the findings from 80 national wildlife refuges, including Sacramento Refuge. The Banking on Nature 2006 study included money spent for food and refreshments, lodging at motels, cabins, lodges or campgrounds, and transportation when it calculated the total economic activity related to refuge recreational use.

Sacramento Refuge had over 137,430 visits in 2006. Refuge visitors enjoyed a variety of activities, including wildlife viewing, hiking, and migratory bird hunting. Non-residents accounted for about 127,408 or 93 percent of recreation visits and almost all of the visits were for non-consumptive recreations (129,257). Sacramento Refuge generated an estimated \$2.4 million in total economic activity related to refuge recreational use with associated employment of 25 jobs, \$773,500 in employment income and \$391,100 in total tax revenue. Total expenditures were \$1.8 million with non-residents accounting for \$1.7 million or 96 percent of total expenditures. Expenditures on hunting accounted for 57 percent of all expenditures, and non-consumptive activities accounted for 43 percent. Sacramento Refuge generated \$2.78 of recreation-related benefits for every \$1 of budget expenditure during 2006. Alternative A provides a minor positive local impact on the economy.

Recreational visits to national wildlife refuges generate substantial economic activity. In 2006, 34.8 million people visited refuges in the lower 48 states for recreation. Their spending generated almost \$1.7 billion of sales in regional economies. As this spending flowed through the economy, nearly 27,000 people were employed and \$542.8 million in employment income was generated. In addition, refuge recreational spending generated about \$185.3 million in tax revenue at the local, county, state and Federal level. About 82 percent of total expenditures are generated by non-consumptive activities on refuges. Fishing accounted for 12 percent and hunting 6 percent. Local residents accounted for 13 percent of expenditures while visitors coming from outside the local area accounted for 87 percent.

More information on the economic impacts of wildlife watching can be found in the report entitled "2001 National and State Economics of Wildlife Watching" (USFWS 2003). Observing, feeding, and photographing wildlife in the United States is an important pastime for millions of Americans and contributes significantly to the national and state economies. In 2001, more than 66 million people 16 years of age and older spent over \$38.4 billion on trips and equipment in pursuit of these activities. Wildlife-watching expenditures contributed substantially to Federal and state tax

revenues (\$6.1 billion), jobs (1,027,833 jobs), earnings, and industry output (\$95.8 billion).

Alternative B, C, and D

Alternatives C and D would increase wildlife-dependent recreation opportunities on the Refuges while Alternative B would reduce these opportunities. Alternatives C and D would result in some increased economic activity to the local area (Alternative D more than Alternative C). It is anticipated that there could be increased employment and spending in the local area for materials, services and contracts related to wildlife dependent recreation at the Refuges. While the increase in public use would not result in a significant effect on the overall local economy, to numerous individuals it could present a substantial gain in overall income. See Chapter 3 of the CCP for more information about the local economy.

Effects of Hunting on the Economy

In 2001, approximately 1.8 million people participated in waterfowl hunting throughout the United States (USFWS 2005a). The majority of waterfowl hunters live in the Mississippi Flyway (44 percent), followed by the Atlantic Flyway (21 percent), the Central Flyway (19 percent), and the Pacific Flyway (15 percent) (USFWS 2005a). Waterfowl hunters spent \$495 million on trip expenses and \$440 million on equipment expenditures in 2001. These expenditures created 21,415 jobs and \$725.2 million in employment income. In 2001, over \$129.5 million in State tax revenue and \$201.8 million in Federal tax revenue was generated.

In 2001, approximately 102,000 people participated in waterfowl hunting in California (USFWS 2005a). Waterfowl hunters spent \$86.5 million on trip expenses and equipment expenditures. These expenditures created 1,303 jobs and \$44.9 million in employment income. In 2001, approximately \$8.4 million in State tax revenue and \$12.5 million in Federal tax revenue was generated in California.

State-wide, California hunters spent an estimated 1,033,989 days and \$27,100,000 to local economies in pursuit of resident game birds alone during the 2002 hunting season (CDFG 2002, USFWS and US Bureau of Census 1993). Although the exact figure is unknown, the CDFG has concluded that approximately 100,000 hunters buy hunting licenses solely for the purpose of hunting resident game birds. If the hunting of resident game birds were to cease, the Department could expect to lose about \$3.77 million in revenues (\$31.25 license + \$6.50 upland game bird stamp x 100,000). A revenue loss of this magnitude would effectively halt all resident game bird management activities.

Hunting on the Refuges (all alternatives) has the potential to result in some economic impacts on the local communities. Because some of the communities in the project area are small, there would be some economic benefits near the hunt areas since hunters from outside the local area visit the region and purchase goods and services from local merchants. This additional spending is likely to generate additional retail sales, income, and possibly short-term employment in businesses such as motels, restaurants, and retail stores. Therefore, Alternative B would result in less economic benefits to the local communities than Alternatives A, C, or D.

However, hunting on Sacramento, Delevan, Colusa, and Sutter Refuges will not result in any economic effects, either direct or indirect, which would produce any significant adverse environmental impacts.

Cultural Resources

Minor impacts to cultural resources could occur under all alternatives since few systematic archaeological surveys have been conducted on the Refuges. Several prehistoric and historic cultural resources have been documented, including one historic district that has been determined eligible for listing in the National Register of Historic Places. These areas have been protected as sanctuaries and therefore are not open to the public. The Service has concluded that there will be no significant effects to cultural resources.

These minor impacts to cultural resources will be minimized through cultural resource reviews and surveys. Under Federal ownership, archaeological and historical resources within a Refuge receive protection under Federal laws mandating the management of cultural resources, including, but not limited to, the Archaeological Resources Protection Act; Archaeological and Historic Preservation Act; Native American Graves Protection and Repatriation Act; and National Historic Preservation Act. Under all alternatives, if any additional cultural resources are discovered on the Refuges, the Service would take all necessary steps to comply with section 106 of the National Historic Preservation Act of 1966, as amended.

Impacts to cultural resources from hunting activities on the Refuge, if any, will be minimal. Sensitive areas of the Refuges have been protected as sanctuaries and therefore are not open to the public. The Service believes that hunting will have no significant effect on cultural resources.

The refuge staff has been involved in discussions/consultations with local Tribes on management issues pertaining to nearby Sacramento River Refuge units containing significant archaeological resources. These discussions have allowed the Service to make informed management decisions as well as improve relationships with local tribes. If similar cultural resource issues arise on Sacramento, Delevan, Colusa, or Sutter Refuges, staff would engage and consult with the appropriate Tribes on management decisions related to culturally and historically significant resources and incorporate those cultural and historical values into the environmental education program. Additional cultural resource information is included in the CCP, Chapter 3.

Climate Change

The Intergovernmental Panel on Climate Change has concluded that warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global average sea level (IPCC 2007). The U.S. Department of the Interior issued an order in January 2001 requiring its land management agencies to consider potential climate change impacts as part of long-range planning endeavors. The increase of carbon within the earth's atmosphere has been linked to the gradual rise in surface temperature commonly referred to as global warming. In relation to comprehensive conservation planning for national wildlife refuges, carbon sequestration constitutes the primary climate-related impact to be considered. The U.S. Department of Energy's report "Carbon Sequestration Research and Development" (USDOE 1999) defines carbon sequestration as "...the capture and secure storage of carbon that would otherwise be emitted to or remain in the atmosphere."

Terrestrial biomes of all sorts – grasslands, forests, wetlands, tundra, perpetual ice and desert – are effective both in preventing carbon emission and acting as a biological "scrubber" of atmospheric carbon monoxide. The Department of Energy's report notes that ecosystem

protection is important to carbon sequestration and may reduce or prevent the loss of carbon currently stored in the terrestrial biosphere.

The actions proposed in all alternatives would preserve or restore land and water, and thus would help mitigate human-induced global climate change through increased vegetation coverage, which in turn enhances the removal and storage of carbon.

Preserving natural habitat for wildlife is the heart of any long-range plan for national wildlife refuges. The actions proposed under any of the alternatives would conserve or restore land and water, and would thus enhance carbon sequestration. This in turn contributes positively to efforts to mitigate human-induced global climate changes.

Although climate change is already affecting wildlife throughout the state (Parmesan and Galbraith 2004), and its effects will continue to increase, it has particular significance for this region's major river and estuarine systems. In general, California winters will likely become warmer and wetter during the next century. Instead of deep winter snowpacks that nourish valley rivers through the long, dry summer, most of the precipitation will be winter rain that runs off quickly. For the Central Valley and the Bay, this means more intense winter flooding, greater erosion of riparian habitats, and increased sedimentation in wetland habitats (Field et al. 1999, Hayhoe et al. 2004). Hotter, drier summers, combined with lower river flows, will dramatically increase the water needs of both people and wildlife. This is likely to translate into less water for wildlife, especially fish and wetland species. Each of the alternatives includes strategies to monitor wetland and riparian habitats as well as wildlife and fish species on the Refuges.

Environmental Justice

On February 11, 1994, the President issued Executive Order 12898 ("Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations") requiring that all Federal agencies achieve environmental justice by "identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." Environmental justice is defined as the "fair treatment for peoples of all races, cultures, and incomes, regarding the development of environmental laws, regulations, and policies.

The mission of the U.S. Fish and Wildlife Service is working with others to conserve, protect, and enhance fish and wildlife and their habitats for the continuing benefit of the American people. The developing environmental justice strategy of the Service extends this mission by seeking to ensure that all segments of the human population have equal access to America's fish and wildlife resources, as well as equal access to information that will enable them to participate meaningfully in activities and policy shaping.

Within the spirit and intent of Executive Order 12898, no minority or low income populations would be impacted by any Service action under any of the Alternatives.

Cumulative Impacts

Cumulative effects (or impacts) are those effects on the environment resulting from incremental consequences of the Service's preferred alternative when added to other past, present, and reasonably foreseeable future actions, regardless of who undertakes these actions. Cumulative effects can be the result of individually minor impacts, which can become significant when added

over a period of time. Accurately summarizing cumulative effects is difficult, because while one action increases or improves a resource in an area, other unrelated actions may decrease or degrade that resource in another area.

As stated in the Service Manual (550 FW 1), in an EA, a cumulative impact assessment should be conducted if it is determined necessary through scoping to make a determination of significance of the proposed action. When a cumulative effects analysis is included in an EA, the analysis need only be sufficient for the decision maker to reach a conclusion on the significance of the impact in order to determine if the preparation of an EIS is required.

This section addresses the potential cumulative effects for all of the alternatives and is intended to consider the activities on Sacramento, Delevan, Colusa, and Sutter Refuges in the context of other actions on a larger spatial and temporal scale. This cumulative effects analysis focuses on two primary areas, the first are habitat improvements in relation to ongoing development, and the second are the cumulative effects of hunting on the Refuges.

Other Past, Present, and Reasonably Foreseeable Actions and Anticipated Impacts

The greatest past, present, and foreseeable future impact in the vicinity of the Refuges is development. There is a clear trend in California of increasing development and associated habitat loss. Additional residential and commercial development may be planned throughout the local area.

All of the alternatives would preserve and enhance existing habitat on the Refuges. All alternatives would have some long-term benefits for native wildlife species and habitats within the area. All of the action alternatives would result in an increase of summer wetlands on the Refuges. In addition, other infrastructure improvements would be made to provide optimal water regimes. The protection and improvement of wildlife habitats within the Refuges would represent a benefit to the long-term conservation of migratory bird species, threatened and endangered species, and other native wildlife species. However, these alternatives will not reverse or halt the regional trend of development and the associated reduction in biological diversity. Therefore, these long-term benefits are not cumulatively significant.

The Refuges do not have much control over the cumulative negative impacts from local development. The Refuges help to mitigate impacts by working with partners to protect important habitats from development.

Cumulative effects involving the public use program would include an overall improvement in the quality of environmental education and wildlife-dependent recreation opportunities. Priority public use opportunities would increase or improve with the establishment of new or enhanced public facilities. These benefits, however, would not be cumulatively significant.

Other Past, Present, and Reasonably Foreseeable Hunts and Anticipated Impacts Past

Sacramento, Delevan, Colusa and Sutter Refuges were established in 1937, 1962, 1944 and 1944, respectively. Hunting has been occurring on Sacramento, Delevan, Colusa, and Sutter Refuges since 1963, 1963, 1950 and 1953, respectively. Hunting has traditionally occurred in the Sacramento Valley on private lands, State owned conservation properties, and federally owned public lands. During scoping and public meetings for the CCP, several Refuge neighbors and

adjacent farmers supported hunting.

There is a long history of hunters investing significant resources into the betterment of many of California's habitats. The interest generated by these programs has resulted in the formation of numerous local sportsmen's organizations dedicated to the protection and improvement of wildlife habitat. Moreover, organizations, such as Ducks Unlimited, California Waterfowl Association, National Wild Turkey Federation, Quail Unlimited, Pheasants Forever, Safari Club International, Safari Club International Foundation, and California Deer Association, invest resources to benefit many types of wildlife.

Present

Wildlife populations are currently hunted on both private and public lands, such as Gray Lodge Wildlife Area (WA) (CDFG), Upper Butte Basin WA (CDFG), Sacramento River WA (CDFG), Sacramento River Refuge (USFWS), and Todd and Foster Islands (Bureau of Land Management). Hunting is a highly regulated activity. It generally takes place at specific times and seasons (dawn, fall and winter) when the game animal is less vulnerable (e.g., breeding season) and in areas where other wildlife-dependent activities (e.g., bird watching, environmental education and interpretation) do not occur, thus reducing the magnitude of disturbance to Refuge wildlife in those areas. Managed and regulated hunting will not reduce species populations to levels where other wildlife-dependent uses will be affected.

Reasonably Foreseeable Future

The Refuges are comprised of 23,126 acres of wetlands, alkali meadows, vernal pools, grasslands, and riparian forests. This diversity of vegetation provides wildlife with high quality breeding habitat; escape cover that offers safety from predators, including humans; shelter from weather-related elements; resting areas; water; and high quality winter habitat, which provides similar food, escape, shelter, resting, and water needs.

Although hunting directly impacts individual animals, the amount of harvest is not expected to have a measurable effect on the Refuges wildlife population levels. In addition, hunting is monitored, regulated, and designed to ensure that harvest does not reduce populations to unsustainable levels. Moreover, the amount of hunting on the Refuges is not expected to increase significantly in the future.

Anticipated Impacts if Individual Hunts are Allowed to Accumulate

In California, 38 refuges provide 471,526 acres of habitat for wildlife. Hunting, fishing, wildlife observation, photography, environmental education, and interpretation are enjoyed by millions of visitors annually. They are also wild places where people can find solace and reconnect with nature.

In California, fourteen refuges are closed to the public. Eighteen refuges, including Sacramento, Delevan, Colusa, and Sutter Refuges, allow waterfowl hunting. Nine of these refuges, including Sacramento, Delevan, Colusa, and Sutter Refuges, also allow pheasant hunting. In addition, Clear Lake Refuge allows pronghorn hunting. Sacramento River Refuge is the only refuge in California to allow deer, quail, turkey, and dove hunting opportunities, in addition to waterfowl and pheasant hunting. Hunting on Sacramento, Delevan, Colusa, and Sutter Refuges will have an extremely minor impact on wildlife species on refuges within California. There is a benefit to California hunters to be able to hunt these species on the Refuges; however, it is not a cumulatively

significant benefit.

There are approximately 22,000 annual hunter visits on the Sacramento, Delevan, Colusa, and Sutter Refuges. The amount of hunters is not expected to increase significantly in the future. In addition, hunting is monitored, regulated, and designed to ensure that harvest does not reduce populations to unsustainable levels. Hunters must report waterfowl and pheasant harvest at each of the Refuge's check stations. Although hunting directly impacts individual animals, the amount of harvest is not expected to have a measurable effect on the Refuges' wildlife population levels. Field checks by refuge law enforcement officers will be planned, conducted, and coordinated with staff and other agencies to maintain compliance with regulations and assess species populations and numbers harvested. The Hunt Plan (USFWS 2008b) describes management actions to address the need for changes to the hunt program if negative impacts are observed by the Service.

Each national wildlife refuge considers the cumulative impacts to hunted migratory species through the Migratory Bird Frameworks published annually in the Service's regulations on Migratory Bird Hunting. Season dates and bag limits for national wildlife refuges open to hunting are never longer or larger than the State regulations. In fact, based upon the findings of an EA developed when a refuge opens a new hunting activity, season dates and bag limits may be more restrictive than the State allows. The harvest management procedures that are in place at a National and State level take in to consideration the status of waterfowl populations prior to determining the appropriate level of harvest permitted that year.

Based on the analysis presented earlier in this chapter, the Service has concluded that there will be no significant cumulative impacts on the Refuges' wildlife populations, either hunted or non-hunted species. Although mortality will occur to some wildlife under the Refuges' hunt program, the analysis presented previously in this chapter supports the conclusion that there would be no adverse population level impacts to hunted or non-hunted wildlife species, even when added to other hunt programs regionally or nationally. The Service has also concluded that the proposed action will not cumulatively impact the Refuges' environment or programs. This determination was based upon a careful analysis of potential environmental impacts of hunting on the Refuges together with other projects and/or actions. Hunting is an appropriate wildlife management tool that can be used to manage wildlife populations. Some wildlife disturbance will occur during the hunting seasons. Proper zoning and regulations will be designated to minimize any negative impacts to wildlife populations using the Refuges.

Unavoidable Adverse Impacts

None of the Alternatives considered would be expected to result in unavoidable adverse impacts on the environment. Where the potential for such effects has been identified, appropriate mitigation measures have been incorporated into the project scope to reduce the effects to below a level of significance. In addition, monitoring of the Refuges' resources would be conducted as part of any proposed management action to enable refuge staff to identify/analyze management results and adapt management policies should any unforeseen problems arise.

Irreversible and Irretrievable Commitments of Resources

Most management actions identified in this document would require a commitment of funds that would then be unavailable for use on other Service projects. At some point, commitment of funds to these projects would be irreversible, and once used, these funds would be irretrievable. Non-renewable or non-recyclable resources committed to projects identified in the CCP would also

represent irreversible and irretrievable commitments of resources, such as fuel for refuge vehicles, supplies used in management or maintenance activities (e.g. herbicide, fencing, signs, etc.), and fuel for construction equipment used to implement enhancement and restoration projects.

Short-term Uses versus Long-term Productivity

An important goal of the Refuge System is to maintain the long-term ecological productivity and integrity of the biological resources on refuges. This system-wide goal is the foundation for the goals presented in the CCP. The implementation of Alternative C would include increased management of wildlife habitats and development of visitor service activities and facilities. The resulting long-term productivity would include increased protection and survival of migratory bird species, endangered species, as well as a myriad of native plant and animal species. The public would also gain through long-term opportunities for wildlife-dependant recreational activities.

Chapter 5. Consultations and Coordination with Others

Agency Coordination and Public Involvement

The CCP and EA were prepared with the involvement of technical experts, community groups, and private citizens. The Service has invited and continues to encourage public participation through the public involvement program consisting of technical panels and project planning updates.

The public workshops, planning updates, and other coordination activities have been previously discussed in the Issue Identification and Public Involvement sections of Chapter 1 of the CCP.

Notice of Intent

A Notice of Intent (NOI) was published in the Federal Register on July 18, 2005.

A Notice of Availability (NOA) was published in the Federal Register in June 2008.

Environmental Review and Coordination

As a Federal agency, the Service must comply with provisions of the NEPA. An environmental assessment was developed under NEPA to evaluate reasonable alternatives that would meet stated objectives and to assess the possible impacts to the human environment. This EA serves as the basis for determining whether implementation of the preferred alternative of the CCP would constitute a major Federal action significantly affecting the quality of the human environment.

Other Federal Laws, Regulations, and Executive Orders

In undertaking the preferred alternative, the Service would comply with the following Federal laws, Executive Orders (EO), and Legislative Acts: Floodplain Management (EEO 11988), Intergovernmental Review of Federal Programs (EO 12372), Protection of Historical Archaeological, and Scientific Properties (EO 11593), Protection of Wetlands (EO 11990), Management of General Public Use of National Wildlife Refuge System (EO 12996), Environmental Justice in Minority Populations and Low-Income Populations (EO 12898), Endangered Species Act of 1973, as amended, Fish and Wildlife Act of 1956, Emergency Wetlands Resources Act of 1986, Refuge Recreation Act as amended, National Wildlife Refuge System Administrative Act of 1966, as amended, National Historic Preservation Act of 1966, as amended, Responsibilities of Federal Agencies to Protect Migratory Birds (EO 13186), Migratory Bird Treaty Act of 1918, the Fish and Wildlife Conservation Act of 1980, as amended, and Neotropical Migratory Bird Conservation Act of 2000. Appendix M of the CCP contains a list of other laws and executive orders that may affect the CCP or the Service's implementation of the CCP. It also contains an overview of policies and plans that are relevant to the Refuges.

Distribution and Availability

1. Public Outreach

This section describes consultation and coordination efforts with the public, interested groups, and other agencies. Section 2 of this section contains the distribution list for the CCP. The organizations and individuals listed in this section were either sent notification about the release

of the Draft CCP or a copy of the Draft CCP. The majority of this list was also sent planning updates or attended the public scoping meetings in 2005.

1.1. Outreach During Scoping

FWS News Release (sent to over 30 media organizations):

- June 17, 2005
- June 30, 2005

Federal Register Notice of Intent:

- Published on July 18, 2005

Public Scoping Meetings:

- July 6, 2005 in Willows
- July 12, 2005 in Colusa
- July 14, 2005 in Yuba City

Newspaper legal notices:

Valley Mirror

- June 29, 2005
- July 6, 2005

Chico Enterprise Record

- June 27, 2005
- July 4, 2005

Colusa County Sun-Herald

- June 29, 2005
- July 6, 2005

Appeal-Democrat

- June 27, 2005
- July 4, 2005

Willows Journal

- June 29, 2005
- July 6, 2005

Other:

- Western Outdoor News newspaper article - July 1, 2005
- USFWS Sacramento National Wildlife Refuge Complex website (<http://sacramentovalleyrefuges/index.htm>)
- California Waterfowl website – Calendar of Events (www.calwaterfowl.org)
- Sacramento River Preservation Trust website (www.sacriverttrust.org)
- Refuge Forum California Flyway website (<http://www.refugeforums.com/refuge/forumdisplay.php?f=29>)

1.2. Outreach Between Scoping and Release of Draft CCP

Planning Updates (sent to 450-500 people/organizations):

- July 2005
- April 2006
- June 2008

Numerous meetings were attended by Refuge staff from 2005 to 2008. At these meetings staff provided updates on the status of the CCP and any comments received were incorporated into the planning process. Also, each of the planning updates made a request for comments. When comments were received, they were incorporated into the planning process.

Websites where the Draft CCP, Planning Updates, and CCP information is provided:

- Sacramento National Wildlife Refuge Complex webpage (<http://sacramentovalleyrefuges/index.htm>)
- USFWS CNO Region Planning webpage (<http://www.fws.gov/cno/refuges/planning.html>)

Newsletters and Other Websites that provided information about the CCP:

- County of Glenn, Rambling
- Sacramento River Preservation Trust (www.sacriverttrust.org)
- California Waterfowl Association Action Alert (www.calwaterfowl.org)
- Refuge Forum California Flyway website (<http://www.refugeforums.com/refuge/forumdisplay.php?f=29>)

2. Distribution List

Federal, State and County Elected Officials

Office of U.S. Senator Barbara Boxer

Office of U.S. Senator Dianne Feinstein

Office of U.S. Representative Wally Herger

Office of State Senator Sam Aanestad

Office of State Assemblyman Doug La Malfa

Office of State Assemblyman Rick Keene

Governor Arnold Schwarzenegger

Supervisor District 1, Kim Vann Colusa County Board of Supervisors

Supervisor District 2, Thomas Indrieri, Colusa County Board of Supervisors

Chairman, Mark Marshall, Colusa County Board of Supervisors

Supervisor District 4, Gary Evans, Colusa County Board of Supervisors

Supervisor District 5, Daniel Yerxa, Colusa County Board of Supervisors

Chairman, Tom McGowan, Glenn County Board of Supervisors

Supervisor District 2, Tracey Quarne, Glenn County Board of Supervisors

Supervisor District 3, John Amaro, Glenn County Board of Supervisors

Supervisor District 4, Michael Murray, Glenn County Board of Supervisors

Supervisor District 5, Keith Hansen, Glenn County Board of Supervisors

Supervisor District 1, Larry Montna, Sutter County Board of Supervisors

Supervisor District 2, Steve ,Cleveland Sutter County Board of Supervisors

Supervisor District 3, Larry Munger, Sutter County Board of Supervisors

Supervisor District 4, Jim Whiteaker, Sutter County Board of Supervisors

Chairman, Dan Silva, Sutter County Board of Supervisors

Federal Agencies

U.S. Department of Agriculture

U.S. Forest Service, Mendocino National Forest
Tom Contreras, Forest Supervisor

Natural Resource Conservation Service – Colusa, Willows, Chico
Ed Burton, State Conservationist
Dean Burkett
Andrea Casey, District Conservationist
Tim Garcia, District Conservationist
Robert Vlach, District Conservationist

U.S. Department of Commerce

National Marine Fisheries Service
Michael Aceitano
Michael Tucker

U.S. Department of Defense

U.S. Army Corps of Engineers
Ronald Light, Colonel
Art Champ, Chief, Regulatory Branch

U.S. Department of the Interior

Bureau of Land Management, Redding
Mark Ackerman
Glen R. Miller, Environmental Coordinator
Steve Anderson, Area Manager

Bureau of Reclamation – Sacramento, Red Bluff, Willows

Dan Meier
Kirk Rodgers, Regional Director, Mid Pacific Regional Office
Basia Trout
Richard Welsh

Fish and Wildlife Service

Sacramento
Steve Thompson, Regional Director
Marge Kolar, Refuge Chief, California and Nevada
Dan Walsworth, Refuge Supervisor, California and Nevada
Mark Pelz, Chief Refuge Planning Office
Art Shine, Chief of Visitor Services
Scott Stevens, Chief of Refuge Law Enforcement
Steve Dyer, Chief Sacramento Realty Office
Rob Holbrook, CVHJV
Robert Shaffer, CVHJV

Alex Pitts, External Affairs
Bart Prose, Div. of Habitat Conservation
Doug Waggoner, Fire Coordinator
Susan Moore, Field Supervisor, Sacramento FWO
Richard Kuyper, Sacramento FWO
Michele Tovar, Sacramento FWO

Red Bluff

James G. Smith, Project Leader, Red Bluff FWO
Tom Kisanuki, Deputy Project Leader, Red Bluff FWO

Portland, OR

Michael Green, MBHP
Anan Raymond, Chief of Cultural Resources
Bob Trost, Division of Migratory Bird Management

National Conservation Training Center
Ann Post Roy, Conservation Library

Geological Survey, Dixon, Vallejo

Mike Casazza
Joe Fleskes
Mike Miller
John Takekawa
Glenn Wylie

Tribal Agencies

Daryl Burrows, Grindstone Indian Rancheria
Wayne Mitchum, Colusa Indian Community Council

State Agencies

CalTrans
Julie Myrah

Department of Fish and Game – Sacramento, Redding, Rancho Cordova, Chico, Willows, Butte City

John Anderson
Andy Atkinson
Randy Benthin
Don Blake, Habitat Supervisor
Tom Blankenship
Scott Clemons, Riparian Habitat Manager, Wildlife Conservation Board
Julie Cunninham
Paul Hofmann, Wildlife Biologist
Diana Jacobs, Deputy Director, Science Advisor
Don Koch, Regional Manager, Region 1
Teresa Leblanc
Sandra Morey, Regional Manager, Region 2

Dan Odenweller, Central Valley Bay Delta Branch
Byron Stone
Glenn Underwood
Paul Ward, Associate Biologist, Marine Fisheries
Dale Whitmore
Dan Yparraguirre

Department of Health Services
Vicki Kramer

Department of Parks and Recreation
Daniel Abeyta, Office of Historic Preservation
Woody Elliott, Senior Resource Ecologist
Robert Foster, Supervisor
Trisha Tillotson, Hydraulics, District 3

Department of Water Resources – Sacramento, Red Bluff
Deputy Director, State Water Project
Annalene Bronson
Barbara Castro
Stacy Cepello
Tito Cervantes
Adam Henderson
James L. Martin, Wetlands Coordinator

Division of Forestry
Paul Hendricks

Fish and Game Commission
Jim Kellogg, President

Resources Agency
Felix Arteaga
Rebecca Fawver
Tim Ramirez

State Board of Reclamation
Benjamin Carter, President of the Reclamation Board

Local

Butte County
Jim Camy, Butte County Mosquito & Vector Control
Yvonne Christopher, Planning Department
Paul Macintosh, Administrative Officer
Bill Olsen, Cooperative Extension

Colusa County

Colusa County Fish and Game
Steven Hackney, Planning Department
John Richter, Dept. of Agriculture
David B. Whitesell, Colusa Mosquito Abatement District
John Wrysinski, Public Works

Glenn County

Jack F. Cavier, Jr., Glenn County Mosquito & Vector Control
William Duckworth, Dept. of Agriculture
Jon Hays, Fish, Game and Recreation Commission
Dan Obermeyer, Planning Department

Sacramento-Yolo County Mosquito and Vector Control District, Elk Grove
David Brown

Sutter County

Larry Combs, Administrative Officer
Mary Keller, Public Works
Mark Quisenberry, Department of Agriculture
Al Sawyer, Public Works
Danelle Stylos, Planning Department
Chuck Wyllie, Fish and Game Commission

Sutter-Yuba County Mosquito Control District
Ron McBride

Fire Departments

Jack Cavier, Artois Volunteer Fire Department
Jason Cooper, Meridian Fire Department
Jim Jacobs, Willows Rural Fire Department
Brad Mallory, Willows City Fire Department
Roger Steinhoff, Kanawha Volunteer Fire Department
Dave Wells, Maxwell Fire District
Jeff Winters, Sacramento River Fire Protection District
Chuck Vanevenhoven, Sutter County Fire Department

Public Libraries

- Bayliss Library
- Butte County Library – Chico Branch
- Butte County Library – Oroville Branch
- Colusa County Library – Colusa Branch
- Colusa County Library – Princeton Branch
- Corning Library
- Orland City Library
- Sutter County Library
- Willows Public Library

- Brent Miller, Head Librarian, Sacramento

Private Groups and Individuals

T. Adkins	S. Carmack
E. Alders	S. Carson
G. Almeida	B. & G. Carter
R. Alvarez	R. Casey
D. Alves	L. Catherwood, The Wilderness Society
H. & A. Andeotti	J. Cave
Animal Protection Institute	Central Valley Project Water Assoc.
J. Arnoldy	R. Chambers, Maxwell Irrigation District
R. Atwood	Chico Sportsman's Den
S. Atwood	A. Chrisney, Riparian Habitat Joint Venture
M. & S. Bachelor	R. Clark, North Delta Water Agency
W. Baer	J. Clarkson
T. Baker	M. Cole
T. Barbour	L. Colvin
R. & J. Barnes	C. Conway
M. Basterrechea	W. Cook
J. Becker, California Bowmen Hunters	T. Copelin
P. Biehn	G. & L. Corbin
B. Billings	D. Cory
L. Blair, RD 108	J. Cosby
J. Bogiatto, California State Univ., Chico	D. Creps, Creps Ranch
J. Bonds	M. D'Arpino, Plan-Tech
G. Bonner	M. Darnell, Middle Mountain Foundation
S. Bostain	D. Davey
D. Bowker, Sac. River Watershed Program	K. Davis
D. Bowman	Davis Ranch
L. Boyd, Princeton-Codora-Glenn Irrig. Dist.	H. Dawson
J. Bremner, Bremner Farms	A. & J. Dell
J. Brennan	G. Delucchi
P. Briggs, Briggs Mfg.	A. Denniston
J. Brooks, Valley Mirror	S. Dicherico
C. Brown	J. Dikeman
C. Brownridge, Refuge Gun Club	C. Dobson, Miller Dairy
A. Brubeck, TEXCAL Energy	D. Dougherty
M. Bumgardner, EIP Assoc.	J. Dwyer
J. Bumpus	J. Eadie, Univ. of California, Davis
D. Burch	T. Ellis
R. Buriani	R. Erwin
P. Buttner, California Rice Commission	J. Espillac, Northeast Corner Ranch
California Native Plant Society	N. Estes
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M. Canale	A. Farrar
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J. Carlon, River Partners	S. Ferrario

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 J. Fisher, Jr.
 L. Forry
 S. Friend
 D. Frye
 Fund for Animals
 D. Fusam
 B. Gaines, California Waterfowl Assoc.
 M. Galentine, Spence Farms
 D. Galloway
 L. Garbutt
 F. Garcia
 B. Gardenhire
 D. Gardner
 M. Gardner
 Granzella's
 G. German
 G. Golet, The Nature Conservancy
 B. Gordon
 R. Greesin
 T. Griggs
 C. Guin
 H. Hacking, Enterprise Record
 B. Hamilton, Univ. of California, Davis
 S. Hartman, National Trappers Assoc. Inc.
 E. Hay
 J. Hays
 H. Hedman
 B. & B. Heins
 B. Henderson
 M. Hennelly, California Waterfowl Assoc.
 P. Hibdon
 C. Hickey, PRBO
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 L. Holman
 T. Hubbs
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 C. Irwin
 C. Jensen
 D. Jespen
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 P. Johnson, Altacal Audubon Society
 T. Johnson, California Rice Commission
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 P. Judge, Judge Bros. Farms

A. Kandler
 B. Karr, Western Outdoor News
 M. & R. Keeley
 E. Keeton
 M. Keller
 P. Kelly
 Kittle's Outdoor & Sport Co.
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 N. Kraemer
 T. Kraemer
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 F. & S. Larrabee, Larrabee Farms
 P. Laughlin, Dean Ranch
 R. Laurson
 S. Lawson, The Nature Conservancy
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 M. Leighty, Mallard Ponds
 J. Lerch
 B. LeVake, Sac. Valley Land Owners Assoc.
 G. Long, Multiple Use Managers, Inc.
 D. Loughman, California Waterfowl Assoc.
 J. Lowe
 R. Lyon
 B. & R. Mackay
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 C. Mann
 W. Mansell, California Rifle & Pistol Assoc.
 R. Massa
 S. Mayberry
 D. Mayberry
 B. Mayo
 Maxwell Country Market
 Maxwell Inn
 J. Mazzoni, NWR Association
 A. McBride, PG&E
 C. McClendon
 B. McCrea
 D. McGeoghan, Gunnersfield Ranch
 B. McGowan
 D. McGuire
 M. McKeough
 T. McKinnon
 J. McMills, Willow Creek Mutual Water Co.
 R. McPherson
 C. Meinberg

J. Melancon, Western Geophysical
 T. Meyer
 E. Migale
 T. Mikesell
 B. Miller
 S. Miller, Colusa Drain Mutual Water Co.
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 G. Page, PRBO
 H. Perez
 K. Peters
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 B. Potter
 C. Poundstone
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 Princeton Market
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 S. Rowlison
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 P. Russell, Sutter Extension Water Dist.

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 J. Scott, United Sportsman
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 J. Snowden
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 M. Steidlmayer
 D. Suford, PRBO
 S. Sutton, Family Water Alliance
 J. Sutton, Family Water Alliance
 V. Tenny, Glenn-Colusa Irrigation District
 R. Thieriot, Parrott Investment Corporation
 A. Thomas, Peratti
 R. Timmer
 W. Todd-Mancillas
 R. Touchon, Calpine-Land Manager
 G. Townley
 J. Tucker
 M. Vaiana
 G. Van Scyoc
 G. Van Scyoc
 D. Vermillion
 J. Vert
 J. Viscuso
 S. Vix
 D. Vogel
 B. Waggershauser
 J. Wagner
 M. Walton
 D. Wasney, Jr.
 J. Waters, California Waterfowl Assoc.
 J. Welz
 G. Werner, The Nature Conservancy
 Westside Outdoorsman
 D. Wilder, Static Motion
 D. Wood, California State Univ., Chico
 D. & M. Wunsch
 D. Yee, Central Valley Bird Club
 D. Zeleke, The Nature Conservancy
 O. Zirkle, Ducks Unlimited

Literature Cited

- Airola, D. A., ed. 1980. California wildlife habitat relationships program: Northeast Interior Zone. Vol III. Birds. U.S. Dep. Agric., For. Serv., Lassen Natl. For., Susanville. 590pp.
- Bartelt, G. A. 1987. Effects of disturbance and hunting on the behavior of Canada goose family groups in east central Wisconsin. *J. Wildl. Manage.* 51:517-522.
- Brown, S., C. Hickey, B. Harrington, and R. Gill, eds. 2001. The U.S. Shorebird Conservation Plan, 2nd ed. Manomet Center for Conservation Sciences, Manomet, MA.
- California Department of Fish and Game (CDFG). 2001. Final Environmental Document Migratory Gamebird Hunting (Waterfowl, Coots, Moorhens). Sacramento, CA. 118 pp.
- California Department of Fish and Game. 2002. Report of the 2002 Game Take Hunter Survey. Sacramento, CA.
- California Department of Fish and Game. 2004a. Final Environmental Documents Regarding Resident Game Bird Hunting. Sacramento, CA. 203 pp.
- California Department of Fish and Game. 2004b. Report of the 2004 Game Take Hunter Survey. Sacramento, CA. 20 pp.
- Cole, D. N. and R. L. Knight. 1990. Impacts of recreation on biodiversity in wilderness. Utah State University, Logan, Utah.
- Cronan, J. M. 1957. Food and feeding habits of the scaups in Connecticut waters. *Auk* 74(4):459-468.
- DeLong, A. 2002. Managing Visitor Use & Disturbance of Waterbirds. A Literature Review of Impacts and Mitigation Measures.
- Field, C. B., G. C. Daily, F. W. Davis, S. Gaines, P. A. Matson, J. Melack, and N. L. Miller. 1999. Confronting climate change in California: Ecological impacts on the Golden State. Cambridge, Mass: The Union of Concerned Scientists and the Ecological Society of America. <http://www.ucsusa.org/documents/calclimate.pdf>.
- Fox, A. D. and J. Madsen. 1997. Behavioral and distributional effects of hunting disturbance on waterbirds in Europe: implications for refuge design. *J. Appl. Ecol.* 34:1-13.
- Hart, C. H. 1990. Management Plan For The Ring-necked Pheasant In California. California Department of Fish and Game publication. 111 pp.
- Hart, C. H., B. Glading, and H. T. Harper. 1956. The Pheasant in California. Pages 90-158 in B. Hines (ed.), "Pheasants in North America". The Stackpole Company, Harrisburg, Pennsylvania, and the Wildlife Management Institute, Washington, D.C. 490 pp.

- Havera, S. P., L. R. Boens, M. M. Georgi, and R. T. Shealy. 1992. Human disturbance of waterfowl on Keokuk Pool, Mississippi River. *Wildl. Soc. Bull.* 20:290-298.
- Hayhoe, K., D. Cayan, C. B. Field, P. C. Frumhoff, E. P. Maurer, N. L. Miller, S. C. Moser, S. H. Schneider, K. N. Cahill, E. E. Cleland, L. Dale, R. Drapek, R. M. Hanemann, L. S. Kalkstein, J. Lenihan, C. K. Lunch, R. P. Neilson, S. C. Sheridan, and J. H. Verville. 2004. Emissions pathways, climate change, and impacts on California. *Proceedings of the National Academy of Sciences* 101(34):12422–12427.
<http://www.pnas.org/cgi/doi/10.1073/pnas.0404500101>.
- Heitmeyer, M. E. and D. G. Raveling. 1988. Winter resource use by three species of dabbling ducks in California. Dept. Wildlife and Fisheries Biology, Univ. of Calif., Davis. Final Report to Delta Waterfowl and Wetlands Research Center, Portage La Prairie, Manitoba, Canada. 200pp.
- Hill, D. A. and P. A. Robertson. 1988. A Population Model As An Aid to Pheasant Management. Pages 149-163 in D. L. Hallett, W.R. Edwards, G.V. Burger (eds), "Pheasants: Symptoms of Wildlife Problems on Agricultural Lands". North Central Section of The Wildl. Soc., Bloomington, IN. 345 pp.
- Intergovernmental Panel on Climate Change (IPCC). 2007. Fourth Assessment Report Climate Change 2007: Synthesis Report.
- Madsen, J. 1985. Impact of disturbance on field utilization of pink-footed geese in West Jutland, Denmark. *Biol. Conserv.* 33:53-63.
- Madsen, J. 1995. Impacts of disturbance on migratory waterfowl. *Ibis* 137:S67-S74.
- Owens, N. W. 1977. Responses of wintering brant geese to human disturbance. *Wildfowl* 28:5-14.
- Parmesan, C., and H. Galbraith. 2004. Observed impacts of global climate change in the U.S. Arlington, Va.: Pew Center on Global Climate Change.
<http://www.pewclimate.org/docUploads/final%5FObsImpact%2Epdf>.
- Paulus, S. L. 1984. Activity budgets of nonbreeding gadwalls in Louisiana. *J. Wildl. Manage.* 48:371-380.
- Peterson, L. R., R. T. Dumke, and J. M. Gates. 1988. Pheasant Survival and the Role of Predation. Pages 165-196 in D. L. Hallett, W.R. Edwards, G.V. Burger (eds), "Pheasants: Symptoms of Wildlife Problems on Agricultural Lands". North Central Section of The Wildl. Soc., Bloomington, IN. 345 pp.
- Raveling, D. G. 1979. The annual cycle of body composition of Canada geese with special reference to control of reproduction. *Auk* 96:234-252.
- Schemnitz, S. D. 1980. *Wildlife Management Techniques Manual*. The Wildlife Society, Washington, D.C.

- Thomas, V. G. 1983. Spring migration: the prelude to goose reproduction and a review of its implication. In Fourth Western Hemispheric Waterfowl and Waterbird Symposium, ed., H. Boyd. 73-81. Ottawa, Canada: Canadian Wildlife Service.
- U. S. Department of Energy (USDOE). 1999. Carbon Sequestration Research and Development. Washington, D.C.: U.S. Department of Energy, Office of Science and Office of Fossil Energy.
- U. S. Department of the Interior (USDI). 1988. Issuance of annual regulations permitting the sport hunting of migratory birds. USFWS. Final supplement environmental impact statement. Washington, D.C. 130 pp.
- U. S. Fish and Wildlife Service (USFWS). 1999. Intra-agency Formal Section 7 Consultation on Management, Operations, and Maintenance of the Sacramento National Wildlife Refuge Complex. Sacramento National Wildlife Refuge Complex, Willows, California.
- U. S. Fish and Wildlife Service. 2003. 2001 National and State Economics of Wildlife Watching. James Caudill, Ph.D. Division of Economics U.S. Fish and Wildlife Service Washington, D.C. August 2003.
- U. S. Fish and Wildlife Service. 2005a. Economic Impact of Waterfowl Hunting in the United States: Addendum to the 2001 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation.
- U. S. Fish and Wildlife Service. 2005b. 2005 Pacific Flyway Data Book: Waterfowl Harvest and Status, Hunter Participation and Success, and Certain Hunting Regulations in the Pacific Flyway and United States. Compiled by R.E. Trost and M.S. Drut. U.S. Fish and Wildlife Service, Portland, OR.
- U. S. Fish and Wildlife Service. 2007. Banking on Nature 2006: The Economic Benefits to Local Communities of National Wildlife Refuge Visitation. E. Carver and J. Caudill. Division of Economics. Washington, D.C. 382 pp.
- U. S. Fish and Wildlife Service. 2008a. Sacramento, Delevan, Colusa, and Sutter National Wildlife Refuges Draft Comprehensive Conservation Plan and EA. U.S. Fish and Wildlife Service, Sacramento, CA.
- U. S. Fish and Wildlife Service. 2008b. Hunt Plan for Sacramento, Delevan, Colusa, and Sutter National Wildlife Refuges. U.S. Fish and Wildlife Service, Sacramento, CA.
- U. S. Fish and Wildlife Service and U.S. Bureau of the Census. 1993. 1991 National survey of fishing, hunting, and wildlife-associated recreation. U.S. Government Printing Office, Washington, DC. 124 pp.
- White-Robinson, R. 1982. Inland and salt marsh feeding of wintering brent geese in Essex. *Wildfowl* 33:113-118.

Wolder, M. 1993. Disturbance of wintering northern pintails at Sacramento National Wildlife Refuge, California. M. S. Thesis, Humboldt State Univ., Arcata. 62pp.