Appendix A. Environmental Assessment

Table of Contents

Figures

Tables

Appendices

Chapter 1. Purpose of and Need for Action

Introduction

This draft environmental assessment (EA) evaluates the environmental effects of four alternatives for managing the Kern and Pixley National Wildlife Refuges (Refuges). This EA will be used by the U.S. Fish and Wildlife Service (Service) 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).

Proposed Action

The Service proposes to implement Alternative C, as described in this EA. This alternative is described in more detail in the CCP.

Purpose of and Need for the Proposed Action

A CCP is needed to guide the management of the Kern and Pixley Refuges. In addition, the National Wildlife Refuge System Improvement Act of 1997 requires that CCPs be in place for all refuges within 15 years of its enactment.

Project Area

Kern and Pixley Refuges are two of several National Wildlife Refuges in California that provide wintering habitat for migratory waterfowl and other waterbirds in the Pacific Flyway (Figure 1). The Refuges are located in the southern end of California's San Joaquin Valley (Figure 2), also known as the Tulare Basin. Kern Refuge is about 19 miles west of Delano, California in northern Kern County. The Refuge consists of a single 10,618-acre unit. It is surrounded by privately owned non-native grassland used for pasture, agricultural croplands, and privately owned wetlands managed as duck clubs. Pixley Refuge is located approximately 19 miles south of the city of Tulare, California in southwestern Tulare County. It consists of 11 units ranging in size from 40 to 900 acres, surrounded by agricultural croplands and pasture.

Decisions to be Made

Based on the analysis documented in this draft EA, the California/Nevada Operations Manager must select one of the management alternatives for Kern and Pixley Refuges and determine whether the selected alternative would have a significant effect on the quality of the environment.

Issue Identification

Issues, concerns, and opportunities were identified through early planning discussions and through the public scoping process, which began with the mailing of the first planning update in August of 1999. Other comments were submitted in writing and through personal communications. For a discussion of the issues, see Chapter 2 of the CCP.

Public Involvement

Three CCP planning updates were distributed to a mailing list of about 210 individuals, groups, and agencies in August 1999, February 2000, and April 2002. Public workshops were held in August of 1999 in Tulare and Bakersfield. In addition, a brochure describing the planning process and requesting input was distributed to refuge visitors during the fall of 1999. The Project Leader gave presentations to several groups including the Tulare Basin Wetlands Association and the Audubon Society.

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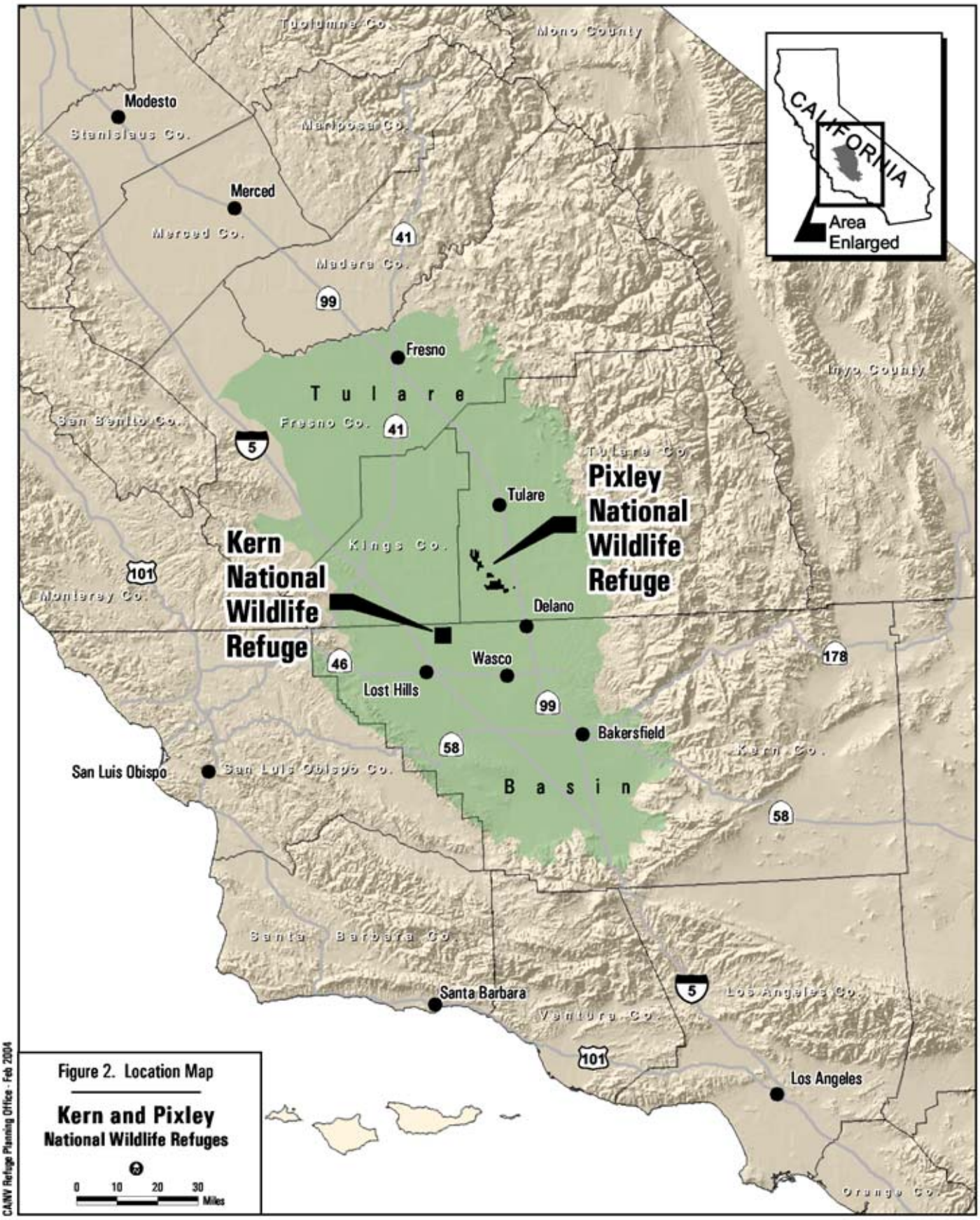

Tuolumne Co.
Mono County
Modesto
Stanislaus Co.
Mariposa Co.
Merced
Merced Co.
41
Madera Co.
99
Fresno
Tulare
Fresno Co.
41
Inyo County
San Benito Co.
5
Tulare Co.
Pixley
National
Wildlife
Refuge
Tulare
Kern
National
Wildlife
Refuge
Kings Co.
101
Monterey Co.
Delano
46
Wasco
178
Lost Hills
99
Bakersfield
58
Kern Co.
San Luis Obispo
San Luis Obispo Co.
Basin
58
Santa Barbara Co.
Santa Barbara
5
Los Angeles Co.
Ventura Co.
101
Los Angeles
Orange Co.
CALIFORNIA
Area
Enlarged
Figure 2. Location Map
Kern and Pixley
National Wildlife Refuges
0 10 20 30
Miles
CA/NV Refuge Planning Office - Feb 2004

Public input received in response to these updates and workshops 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 the California/Nevada Refuge Planning Office in Sacramento, California, and are available for review.

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 Kern and Pixley 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 summarizes these major laws, regulations, and policies and describes the goals of the Refuge System.

Refuge Purposes

Kern Refuge was established under the authority of the Migratory Bird Conservation Act ". . . for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." (16 U.S.C. § 715d)

Pixley Refuge was set aside to provide wintering habitat for migratory birds and protect habitat for the endangered blunt-nosed leopard lizard. The authorities and corresponding purposes for which Pixley Refuge was established are: (1) Bankhead-Jones Farm Tenant Act ". . . a land-conservation and land-utilization program . . ." 7 U.S.C. § 1011; (2) Secretarial Order 2843, dated November 17, 1959 ". . . for migratory birds and other wildlife: . . ."; and (3) Endangered Species Act of 1973 ". . . to conserve (A) fish or wildlife which are listed as endangered species or threatened species . . . or (B) plants . . ." 16 U.S.C. § 1534.

Goals for the Kern Refuge

Goal 1: Provide high quality wintering and migratory habitat for migratory birds in the southern San Joaquin Valley, with an emphasis on waterfowl and waterbirds.

Goal 2: Protect, preserve, and restore alkali sink scrub, saltbush scrub, iodine bush scrub and grassland habitats in the southern San Joaquin Valley to contribute to the recovery plan goals for the San Joaquin kit fox, blunt-nosed leopard lizard, and Tipton's kangaroo rat.

Goal 3: Restore and maintain a representative example of Tulare Basin grassland, riparian, and sink scrub habitats on Kern Refuge.

Goal 4: Provide visitors with wildlife- dependant recreation, interpretation, and education opportunities which foster an appreciation and understanding of Kern Refuge’s unique wildlife, plant communities and cultural resources.

Goals for the Pixley Refuge

Goal 1: Protect, restore, and manage alkali sink scrub, saltbush scrub, iodine bush scrub and grassland habitats in the southern San Joaquin Valley to contribute to the recovery plan goals for the San Joaquin kit fox, blunt-nosed leopard lizard, and Tipton's kangaroo rat.

Goal 2: Restore and maintain a representative example of Tulare Basin grassland and riparian habitat on Pixley Refuge.

Goal3: Provide high quality wintering and migratory habitat for migratory birds in the southern San Joaquin Valley, with an emphasis on waterfowl, sandhill cranes, and other waterbirds.

Goal 4: Provide visitors with wildlife-dependant recreation, interpretation, and education opportunities which foster an appreciation and understanding of Pixley Refuge's unique wildlife and plant communities.

Chapter 2. Alternatives, Including the Proposed Action

Introduction

This chapter describes four alternatives for managing Kern and Pixley Refuges: Alternative A, No Action; Alternative B, Emphasize Waterfowl; Alternative C, Emphasize Migratory Birds and Special Status Species; and Alternative D, Emphasize Biodiversity. These alternatives are summarized in Tables 1 and 2 and described below. Appendix 1 includes more detailed descriptions includes goals, objectives, and strategies for each alternative. Figures 3, 4, and 5 show a graphical representation of these alternatives. The Service's proposed action 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. Under the Continue Current Management alternative, the Service would continue managing Kern and Pixley Refuges as it currently does.

Current Management

Kern Refuge

Current management of the Kern Refuge is guided by a Master Plan developed in 1986. Management efforts are focused on creation and maintenance of quality wetland habitat for migratory birds with an emphasis on waterfowl and water birds; protection of threatened and endangered species and enhancement of their habitats; and providing quality wildlife-dependant recreational opportunities.

Wetland habitat creation and maintenance has been a major emphasis since the inception of the Refuge due to the absence of naturally occurring marsh habitat in the southern valley. Water management regimes involving specific water draw down dates, spring irrigations and fall flood-up periods are followed to produce quality habitat within the wetlands of the Refuge. Non-native grasslands are managed for use by several threatened and endangered species through the implementation of a closely monitored cattle-grazing program. Control of non-native, invasive plant species such as salt cedar is ongoing to improve both wetland and upland habitats.

Public uses such as wildlife observation, photography and waterfowl hunting have long been available on limited areas of the Refuge and are compatible with the purposes for which the Refuge was established.

Periodic wildlife surveys within various habitat types are conducted to monitor population trends of waterfowl, raptors, shorebirds and other resident and migratory species. Surveys are periodically conducted to determine the presence or absence of threatened and endangered species such as San Joaquin kit fox, blunt-nosed leopard lizard, and Tipton kangaroo rats.

Pixley Refuge

As is the case with Kern, management of Pixley Refuge is guided by a Master Plan developed in 1986. Since annual grasslands comprise over 74 percent of the area within the approved refuge boundary, management of this habitat type that supports threatened and endangered species, is of primary concern. Closely monitored cattle grazing is the primary management tool utilized to reduce the grass cover and provide more open habitat suitable to the endangered blunt-nosed leopard lizard and Tipton kangaroo rat. Although very limited in scope, seasonal wetlands are created and maintained on approximately 300 acres of impoundments in the southwestern portion of the Refuge adjacent to the Deer Creek channel. These moist soil units are maintained during the fall and winter for the benefit of waterbirds including ducks, geese, sandhill cranes, and other wading and shorebirds. Although foraging habitat for cranes on the Refuge is limited, use of Refuge ponds as roosting areas is generally increasing on an annual basis.

Table 1. Alternatives Summary: Kern Refuge.

Topic	*Alternative A – Continue Current Management*	*Alternative B – Emphasize Waterfowl Management and Hunting*	*Alternative C – Emphasize Migratory Bird and Wildlife-Dependant Public Use*	*Alternative D – Emphasize Native Biodiversity and Non-consumptive Public Use*
Overview				
Refuge focus	Remains the same: provide wintering habitat for migratory waterfowl	Provide wintering habitat for migratory waterfowl	Provide wintering habitat for migratory birds and contribute to the recovery of targeted special status species	Maximize native biodiversity and contribute to the recovery of targeted special status species
Summary of management changes	■ Continue current management and public use with out change	■ Expand and improve management programs for migratory waterfowl ■ Expand and improve opportunities for consumptive public use (hunting)	■ Expand and improve management programs for migratory waterfowl, colonial nesting species, threatened and endangered species, riparian communities, and native uplands ■ Expand and improve opportunities for both consumptive and non-consumptive public use	■ Expand and improve management programs for migratory waterfowl, colonial nesting species, threatened and endangered species, riparian communities, and native uplands ■ Expand and improve opportunities for non-consumptive public use and scale back hunting program
Migratory Birds (Goal 1)				
Wintering and migratory habitat for waterfowl and shorebirds	■ Continue existing management of moist soil units to maximize swamp timothy and millet production	■ Slightly modify management of moist soil units to maximize diversity of high energy waterfowl food plants	■ Same as Alternative B	■ Substantially modify management of moist soil units to maximize diversity of native food plants and improve habitat for shorebirds
	■ Complete rehabilitation of unit 14 to provide 1,200 acres of new moist soil habitat (Figure 3)	■ Same as Alternative A	■ Same as Alternative A	■ Same as alternative A
	■ Continue existing marsh management	■ Continue existing marsh management; rehabilitate units 7 and 8 to improve water efficiency	■ Same as Alternative B plus eradicate 90% of salt cedar in marsh units within 5 years and rehabilitate former research unit (7b) into 180 acres of seasonal marsh	■ Same as Alternative C but research unit would be rehabilitated into a 180 acre moist soil unit
	■ Continue existing botulism control practices	■ Same as alternative A	■ Same as alternative A	■ Same as alternative A
	■ Continue to provide existing flexible closed zone; as wetlands are flooded up, the first 1,000 acres are closed, then 55% are closed with 45% open (4,223 acres of permanent sanctuary)	■ Decrease size of closed zone; after the first 1,000 acres are closed, close 30%, with 70% open (2,531 acres of permanent sanctuary)	■ Same as Alternative A (3,504 acres of permanent sanctuary when unit 14 is developed as a moist soil unit)	■ Increase size of closed zone (5,140 acres of permanent sanctuary when unit 14 is developed as a moist soil unit)

Topic	*Alternative A – Continue Current Management*	*Alternative B – Emphasize Waterfowl Management and Hunting*	*Alternative C – Emphasize Migratory Bird and Wildlife-Dependant Public Use*	*Alternative D – Emphasize Native Biodiversity and Non-consumptive Public Use*
Nesting habitat for tricolor blackbirds, white-faced ibis and other colonial nesting species	■ Continue to manage 300-acre portion of unit 1 for colonial nesting species (maintain summer water)	■ Discontinue management of unit 1 for colonial nesting species	■ Same as Alternative A	■ Same as Alternative A
Surveys and monitoring	■ Continue existing limited survey and monitoring program	■ Expand aerial surveys for waterfowl	■ Expand aerial surveys of waterfowl and ground surveys of shorebirds, waterbirds, and raptors	■ Same as Alternative C
Wetland habitat protection and enhancement	■ No wetland habitat protection or enhancement would be implemented	■ Prepare land protection plan which evaluates alternatives for protecting and enhancing up to 16,000 acres of southern San Joaquin Valley wetlands	■ Same as Alternative B	■ Same as Alternative B
Threatened and Endangered Species (Goal 2)				
Habitat management	Continue existing program: ■ grazing program to improve habitat suitability for listed species	■ Same as Alternative A	Expand habitat management: ■ grazing ■ experimental burns ■ monitor habitat and population response	■ Same as Alternative C,
Habitat flood protection	■ Continue to protect uplands from flooding by rejecting Poso Creek flood flows after wetland units are filled to capacity	■ Same as Alternative A	■ Increase flood protection for uplands by strengthening levees surrounding unit 14 ■ renegotiating flood water management agreement	■ Same as Alternative C
Habitat linkage	■ No habitat linkage would be pursued	■ Prepare and implement a land protection plan which evaluates alternatives for establishing linkages between Kern Refuge and other natural lands in the area	■ Same as Alternative B	■ Same as Alternative B
Research and monitoring	■ Continue limited presence/absence surveys for threatened and endangered species	■ Same as Alternative A	■ Substantially expand monitoring program for special status species ■ Prepare comprehensive surveying and monitoring plan for special status species	■ Same as Alternative C
Native Diversity (Goal 3)				
Riparian habitat management	■ Continue periodic flooding of riparian habitat in fall, winter, and	■ Same as Alternative A	■ Continue periodic flooding of riparian habitat in fall, winter, and early spring	■ Same as Alternative C

Topic	*Alternative A – Continue Current Management*	*Alternative B – Emphasize Waterfowl Management and Hunting*	*Alternative C – Emphasize Migratory Bird and Wildlife-Dependant Public Use*	*Alternative D – Emphasize Native Biodiversity and Non-consumptive Public Use*
	early spring ■ Continue monthly irrigation during summer	■ Same as Alternative A	■ Continue monthly irrigation during summer ■ Control salt cedar using mechanical, chemical, and/or biological means	■ Same as Alternative C
Riparian habitat expansion	■ No riparian habitat expansion would occur	■ Plant 7 acres of riparian vegetation along canals surrounding unit 14	■ Plant 15 acres of riparian vegetation along canals surrounding unit 14	■ Plant 30 acres of riparian vegetation along canals surrounding unit 14
Native upland plant community restoration	■ No native upland plant community restoration would occur	■ No native upland plant community restoration would occur	■ Eradicate 90% of salt cedar in riparian and upland habitat within 10 years ■ Restore 440 acres of saltbush scrub in unit 13 ■ Prepare grassland management plan	■ Same as Alternative C
Research	■ Continue allowing research	■ Continue allowing research	■ Encourage and provide opportunities for research	■ Same as Alternative C
Public Use (Goal 4)				
Outreach	Continue limited outreach program	Expand refuge outreach: ■ Develop friends group ■ Give refuge presentations at schools, public events, and public service and conservation group meetings ■ Plan and conduct waterfowl expo at refuge each fall ■ Purchase displays (general and refuge specific)	■ Same as Alternative B	■ Same as Alternative B
Hunting	Maintain existing hunting opportunities (Figure 4): ■ 11 spaced blinds ■ 2,180 acres free roam hunt area ■ Hunt days: Wed and Sat	Substantially increase hunting opportunities: ■ 28 spaced blinds ■ 2,369 acres free roam hunt area ■ Hunt days: Wed, Sat, and Sun ■ Increase law enforcement presence	Increase hunting opportunities: ■ 20 spaced blinds ■ 2,180 acres free roam hunt area ■ Hunt days: Wed and Sat ■ Increase law enforcement presence	Reduce hunting opportunities: ■ 11 spaced blinds ■ 1,165 acres free roam hunt area ■ Hunt days: Wed and Sat ■ Increase law enforcement presence
Environmental education and interpretation	Maintain limited environmental education and interpretation programs	Expand environmental education and interpretation program: ■ Develop and implement public use plan	Substantially expand environmental education and interpretation programs: ■ Develop and implement public use plan	Same as Alternative C

Topic	*Alternative A – Continue Current Management*	*Alternative B – Emphasize Waterfowl Management and Hunting*	*Alternative C – Emphasize Migratory Bird and Wildlife-Dependant Public Use*	*Alternative D – Emphasize Native Biodiversity and Non-consumptive Public Use*
		■ Establish partnerships with educational institutions and local organizations ■ Develop educational materials	■ Establish partnerships with educational institutions and local organizations ■ Develop educational materials ■ Develop new interpretive signs and displays and new refuge brochure ■ Develop kiosk, boardwalk, and enhance pond at refuge entrance	
Wildlife observation and photography	■ Continue to maintain existing 6-mile tour route	■ Continue to maintain existing 6-mile tour route ■ Development and implement public use plan	■ Continue to maintain existing 6-mile tour route ■ Develop and implement a public use plan ■ Construct new 4.3-mile tour route (open every day) ■ Construct 2 new photo blinds	■ Continue to maintain existing 6-mile tour route ■ Develop and implement a public use plan ■ Construct a new 4.3-mile tour route (open every day) ■ Construct 2 new photo blinds ■ Construct a new 7.4-mile tour route (open on non-hunt days)
Cultural resources	■ Survey, identify, and evaluate sites within planned development areas	■ Survey, identify, and evaluate sites within planned development areas ■ Create and utilize a Memorandum of Agreement with Native American groups to implement the inadvertent discovery clause of the Native American Graves Protection and Repatriation Act	■ Survey, identify, and evaluate sites within planned development areas ■ Update and expand existing cultural resources overview ■ In consultation with Tribes and local historical societies, prepare interpretive media (e.g., pamphlets, signs, exhibits) ■ Create and utilize a Memorandum of Agreement with Native American groups to implement the inadvertent discovery clause of the Native American Graves Protection and Repatriation Act	■ Same as Alternative C
Staffing and Cost Summary				
Staffing needs (for Kern and Pixley Refuges)	Maintain current staffing: ■ Project leader ■ Deputy project leader ■ Wildlife biologist ■ Private lands biologist ■ Administrative support assistant ■ Office automation clerk	Increase staff to: ■ Project leader ■ Deputy project leader ■ Wildlife biologist ■ Private lands biologist ■ Administrative support assistant ■ Office automation clerk	Increase staff to: ■ Project leader ■ Deputy project leader ■ Wildlife biologist ■ Private lands biologist ■ Administrative support assistant ■ Office automation clerk	■ Same as alternative C

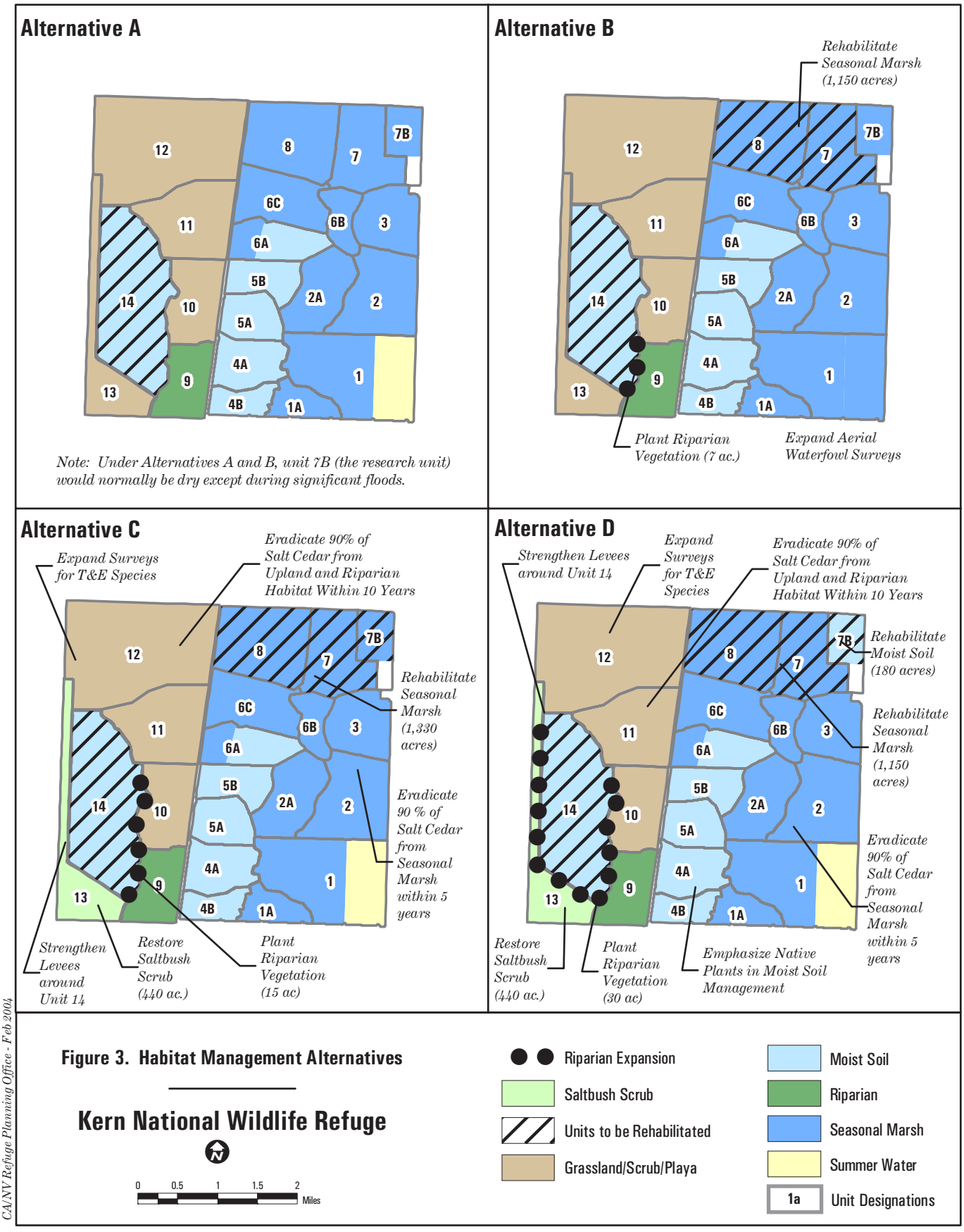
Topic	*Alternative A – Continue Current Management*	*Alternative B – Emphasize Waterfowl Management and Hunting*	*Alternative C – Emphasize Migratory Bird and Wildlife-Dependant Public Use*	*Alternative D – Emphasize Native Biodiversity and Non-consumptive Public Use*
	■ Refuge operations specialist ■ 2 engineering equipment operators	■ Refuge operations specialist ■ 4 engineering equipment operators ■ Outdoor recreation planner ■ Law Enforcement Officer	■ Refuge operations specialist ■ 4 engineering equipment operators ■ Outdoor recreation planner ■ Law Enforcement Officer ■ Biological Science Technician	

Table 2. Alternatives Summary: Pixley Refuge

Topic	*Alternative A – Continue Current Management*	*Alternative B – Emphasize Waterfowl and Special Status Species*	*Alternative C – Emphasize Special Status Species and Migratory Birds*	*Alternative D – Emphasize Special Status Species and Biodiversity*
Overview				
Refuge focus	Remains the same: Contribute to the recovery of targeted special status species and provide wintering habitat for migratory birds	Same as Alternative A	Same as Alternative A	Contribute to the recovery of targeted special status species and maximize native biodiversity
Summary of management changes	■ Continue current management and public use with out change	■ Expand and improve management programs for special status species and migratory waterfowl ■ Expand and improve opportunities for non-consumptive public use	■ Expand and improve management programs for special status species, migratory waterfowl, and riparian communities ■ Expand and improve opportunities for non-consumptive public use	■ Expand and improve management programs for special status species, migratory waterfowl, and riparian communities ■ Expand and improve opportunities for non-consumptive public use
Threatened and Endangered Species (Goal 1)				
Habitat management	■ Continue existing grazing program to improve habitat suitability for listed species (Figure 5)	■ Same as Alternative A	■ Prepare a grassland management plan which explores different grazing regimes and monitoring effects on	■ Same as Alternative C
Habitat protection and linkage	■ No habitat protection or linkage would be pursued	■ Pursue willing seller acquisition of remaining natural lands within the approved refuge boundary	■ Pursue willing seller acquisition of remaining natural lands within the approved refuge boundary ■ Prepare and implement a land protection plan which evaluates alternatives for protecting natural lands around Pixley Refuge and Allensworth Natural Area and linking them with other natural lands to the north and Kern Refuge to the southwest	■ Same as Alternative C
Research and monitoring	■ Continue limited presence / absence surveys for threatened and endangered species	■ Expand surveying and monitoring program for special status species	■ Substantially expand survey and monitoring program for special status species ■ Prepare comprehensive surveying and monitoring plan for special status species ■ Substantially expand research on kit fox, blunt-nosed leopard lizard, and Tipton kangaroo rat biology, ecology, and habitat management	■ Same as Alternative C

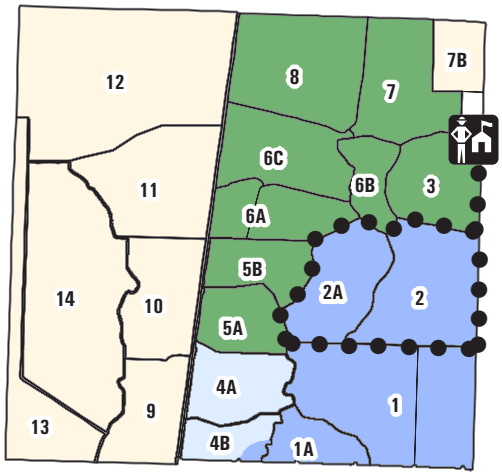
Topic	*Alternative A – Maintain Current Management*	*Alternative B – Waterfowl and Special Status Species Emphasis*	*Alternative C – Special Status Species and Migratory Bird Emphasis*	*Alternative D – Special Status Species and Native Diversity Emphasis*
Migratory Birds (Goal 2)				
Wintering and migratory habitat for waterfowl and waterbirds	■ Continue existing management of moist soil units to maximize swamp timothy and millet production	■ Slightly modify management of moist soil units to maximize diversity of high energy waterfowl food plants	■ Same as Alternative B ■ Develop 272-acre grain unit (foraging habitat) in the Turkey Tract	■ Substantially modify management of moist soil units to maximize diversity of native food plants and improve habitat for shorebirds ■ Same as alternative C
	■ Continue existing botulism control practices	■ Same as alternative A	■ Same as alternative A	■ Same as alternative A
Surveys and monitoring	■ Continue existing limited survey and monitoring program	■ Expand aerial surveys for waterfowl	■ Expand aerial surveys of waterfowl and ground surveys of shorebirds, waterbirds, and raptors	■ Same as Alternative C
Native Diversity (Goal 3)				
Riparian habitat expansion	■ No riparian habitat expansion would occur	■ Plant 5 acres of riparian vegetation along the service ditch	■ Plant 10 acres of riparian vegetation along the service ditch and north levee	■ Plant 20 acres of riparian vegetation along the service ditch and north, south, and west levees
Grassland restoration and management	■ No grassland restoration and management plan would be prepared	■ No grassland restoration and management plan would be prepared	■ Prepare and implement a grassland restoration and management plan	■ Same as Alternative C
Public Use (Goal 4)				
Environmental education and interpretation	■ Maintain limited environmental education and interpretation opportunities (Figure 5)	Expand environmental education and interpretation program: ■ Develop and implement public use plan ■ Establish partnerships with educational institutions and local organizations ■ Develop educational materials	Substantially expand environmental education and interpretation programs: ■ Develop and implement public use plan ■ Establish partnerships with educational institutions and local organizations ■ Develop educational materials ■ Develop new interpretive signs and displays and a new refuge brochure	Same as Alternative 3
Wildlife observation and photography	■ Maintain trail and viewing platform	■ Maintain trail and viewing platform ■ Develop and implement a public use plan	■ Same as Alternative B plus ■ Develop pullout and interpretive displays at	■ Maintain trail and viewing platform ■ Develop and implement a public use plan ■ Develop pullout and interpretive displays at

Topic	*Alternative A – Maintain Current Management*	*Alternative B – Waterfowl and Special Status Species Emphasis*	*Alternative C – Special Status Species and Migratory Bird Emphasis*	*Alternative D – Special Status Species and Native Diversity Emphasis*
			the Turkey Tract	the Turkey Tract ■ Develop parking lot and vernal pool foot trail
Outreach		Expand refuge outreach: ■ Develop friends group ■ Give Refuge presentations at schools, public events, and public service and conservation group meetings	Same as Alternative B	Same as Alternative B
Cultural resources	■ Continue to provide law enforcement protection for existing cultural sites ■ Conduct cultural resources surveys prior to starting ground disturbing work	■ Same as Alternative A	■ Same as Alternative A	■ Same as Alternative A

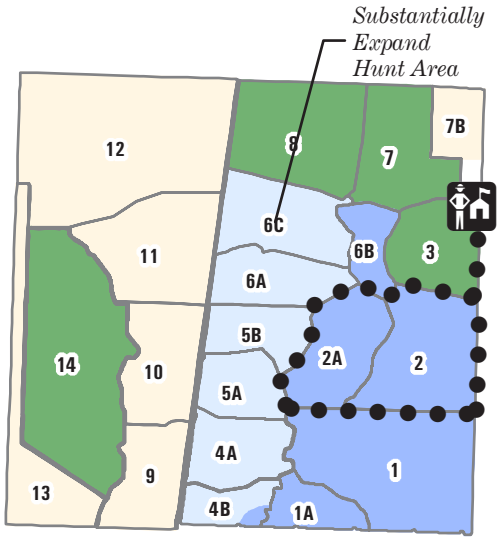


CA/NV Refuge Planning Office - Feb 2004

Alternative A

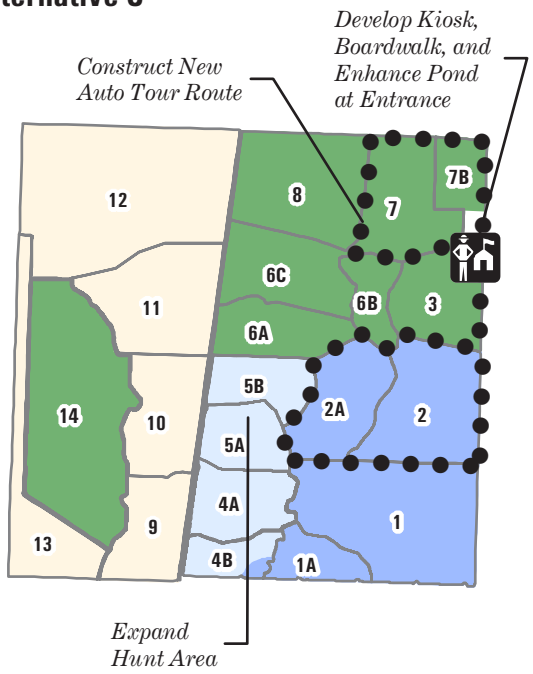


Alternative B



Open the Refuge to Hunting on Sundays (In Addition to Wednesdays and Saturdays)

Alternative C



Alternative D

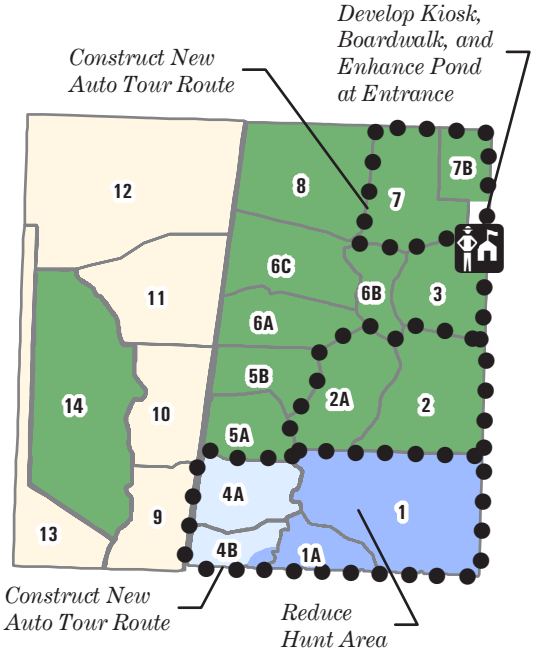


Figure 4. Visitor Services Alternatives

Kern National Wildlife Refuge

Hunt Areas

- Free Roam
- Blinds
- Unit Designations
- Refuge Headquarters

Closed Areas

- Other areas closed to hunting
- Wetlands closed to hunting
- Interpretive Auto Tour Routes

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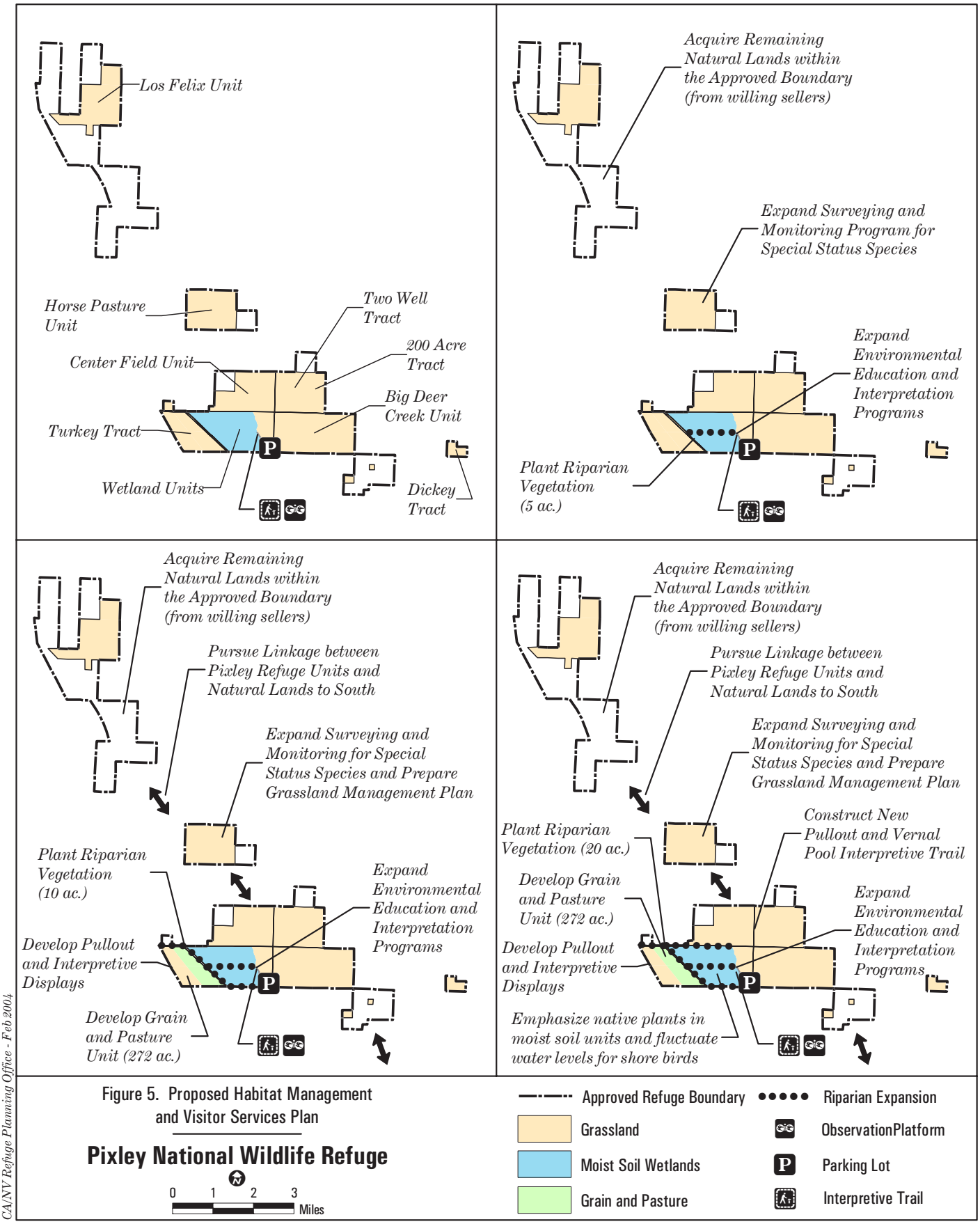


Figure 5. Proposed Habitat Management and Visitor Services Plan

Pixley National Wildlife Refuge

CA/NV Refuge Planning Office - Feb 2004

Current public use of the Refuge is limited to organized tours and use of a newly opened self-guided interpretive trail and observation platform located on the eastern margin of the wetland area. Most visitors are attracted to the Refuge by the opportunity to view the large number of sandhill cranes that return to the Refuge each evening at dusk.

Periodic wildlife surveys within various habitat types are conducted to monitor population trends of waterfowl, raptors, shorebirds and other resident and migratory species. Surveys are periodically conducted to determine the presence or absence of San Joaquin kit fox along survey routes established on the Refuge. Service staff from the Endangered Species Recovery Program conduct census surveys along established transects on the Refuge to monitor populations of blunt-nosed leopard lizards and Tipton kangaroo rats.

Features Common to All Alternatives

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

Kern Refuge

Rehabilitation of Unit 14. The Service would continue the ongoing rehabilitation of unit 14 to provide 1,200 acres of new moist soil habitat.

Riparian Habitat Maintenance. The Service will continue to maintain 450 acres of existing riparian habitat in Unit 9 by periodically flooding it in fall, winter, and early spring and irrigating it monthly during summer.

Mosquito Control. The Kern Mosquito Vector Control District (KMVCD) has been monitoring and controlling mosquito populations on the Refuge since 1983. During an average mosquito monitoring period, typically between the months of April and October, the KMVCD assesses mosquito populations by using a dip net to detect the number of mosquito larvae in the seasonal marsh and moist soil units and riparian areas. Mosquito adult populations are assessed with CO2 traps. When one or more larvae are captured per dip, KMVCD would treat larval mosquitoes using *Bacillus thuringiensis serovar. israelensis* (Bti) and methoprene.

Applications of larvicides may occur anywhere in the wetland and moist soil units of the Refuge. The potential wetland areas for mosquito breeding and consequently mosquito treatment is 7,900 acres. The KMVCD applies these larvicides from a tank mounted on a truck, from a backpack sprayer, or, when serious outbreaks occur, through aerial applications from a fixed-wing aircraft. Mosquito control applications normally occur during the months of August, September, and October when the Refuge begins the annual fall flood-up for migrating waterfowl; however, applications can occur anytime between the months of April to November depending on environmental conditions. Applications can occur anywhere in the wetland and moist soil units of the Refuge, total area for potential mosquito breeding and consequently mosquito treatment is 7,900 acres. The total area of the Refuge that is treated varies with the conditions of each year.

The range in area treated in the last five years varied from a low of 1677 acres in 2003 to a high of 2468 acres in 2002. Some of these areas are treated more than once. Between 1988 and 2000, 5 to 10 treatments occurred per season. More recently, the number of treatments required has risen to 13 in 2001, 19 in 2002, and 16 in 2003. The average area covered per treatment is 263 acres. If efforts to control immature mosquitoes fail to prevent adult trap counts from exceeding 150 per night, and WNV and/or WEE or SLE are detected within or near the Refuge, KMVCD proposes to treat infested areas with a mosquito adulticide. KMVCD proposes to use the adulticides Pyrocide or Pyrenone, which have natural pyrethrins as the active ingredient.

Disease Monitoring and Control. Under all alternatives, existing botulism control practices would continue, including keeping all units (except the eastern portion of unit 1) dry between the first of June 1 and the first of August; patrolling historically problematic wetlands on the Refuge and in the surrounding areas in cooperation with the California Department of Fish and Game; and removing sick birds and carcasses from wetlands.

Fire Management. Prescribed fire has been an integral part of wetland management on the Complex since 1980. Under each alternative, prescribed fire will be used to manage wetland vegetation in seasonal marshes and moist soil wetlands to remove excess vegetation. This creates a mosaic of open water and emergent vegetation that provides for less intense fires and increases habitat quality for many waterfowl and waterbird species. Each year, prescribed fire activity would be established and coordinated annually as part of the annual work plan between the refuge managers, biological staff, and zone fire management officer. Approximately 5 to 10 percent of the Complex's total moist soil and seasonal marsh acreage would be treated annually. Prescribed fire will not occur in upland habitats used by threatened and endangered species.

Wildland fires that may threaten or occur in upland habitats will be suppressed. Wildland fires will be contained using natural firebreaks, e.g. roads, levees, canals, etc. Heavy fire equipment will be kept on roads to prevent getting stuck. However, if the fire threatens private property or if any other situation exists that constitutes an immediate threat to human life or property, then immediate, total suppression efforts will be taken. Roads and canals on the refuges will be maintained by mowing, grading, or spraying to act as fire breaks in the event of a wildland fire. New firebreaks will not be created through upland habitat.

Pixley Refuge
Mosquito Control. The Tulare Mosquito Abatement District (TMAD) has been monitoring and controlling mosquito populations on the Refuge since 1963. During an average mosquito-monitoring period, typically between the months of April and November, TMAD assesses adult mosquito populations using CO2 traps, and mosquito larvae using dip nets, to detect the number of larvae in the moist soil units and riparian areas. When two or more larvae are captured per dip, TMAD will employ the use of either the bacterium *Bacillus thuringiensis israelensis* (Bti) or the juvenile hormone analog methoprene.

Applications of larvicides may occur anywhere in the moist soil units of the Refuge. The potential wetland areas for mosquito breeding and consequently mosquito treatment are 450 acres. Mosquito control applications can occur anytime between April through November, depending on environmental conditions, but normally occur during from mid-August through October, when water is being added to the wetland units.

Treatment will be conducted mainly by aerial application in areas where monitoring has documented high mosquito larval densities or high concentrations of a specific vector bearing mosquito species. Aerial application has been done using fixed-wing aircraft flown at an altitude of 10-20 feet above the vegetation and at airspeeds of 130-140 miles per hour.

If efforts to control immature mosquitoes fail to prevent adult trap counts from exceeding 150 per night, and WN, WEE, or SLE are detected within or near the Refuge, and a public health emergency is declared by the state or county, TMAD proposes to treat infested areas with a mosquito adulticide.

Proposed Action

The planning policy that implements the Improvement Act of 1997 requires the Service to select a preferred alternative that becomes its proposed action under NEPA. The written description of this proposed action is effectively the draft CCP. Alternative C is the proposed action for Kern and Pixley Refuges because it best meets the following criteria.

- Achieves the mission of the National Wildlife Refuge System.

- Achieves the purposes of Kern and Pixley National Wildlife Refuges.
- Provides guidance for achieving the Refuges' 15-year visions and goals..
- Maintains and restores the ecological integrity of the habitats and populations on the Refuges.
- Addresses the important issues identified during 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 proposed action described in this 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 proposed action presented in the final CCP may or may not be the preferred alternative presented in this version; the final CCP may propose a modification of one of the alternatives presented here.

Alternative A: Continue Current Management

Kern Refuge

Under Alternative A, the Service would continue to manage Kern Refuge as it has in the recent past. In general, management would be guided by the Master Plan adopted in 1986. The focus of the Refuge would remain the same, to provide wintering habitat for migratory waterfowl. Current staffing and funding needs would remain the same.

Migratory Birds. Under Alternative A, the Service would continue existing management of moist soil and seasonal marsh units. Wetland units would be flooded up in August and draw down would begin in March. Moist soils units would be irrigated once or twice in April and May to assist in the germination of swamp timothy. Each year 25 percent of the moist soil and seasonal marsh units would be burned, disked, or mowed.

To provide sanctuary for wintering birds and other wildlife, the existing flexible closed zone would be maintained as follows: the first 1,000 acres of wetlands to be flooded are closed to public use; as the remaining wetlands are flooded, 45 percent are open and 55 percent are closed (3,023 acres of permanent sanctuary). The Service would continue to maintain water through most of the summer in the eastern portion of unit 1 to provide nesting habitat for tricolor blackbirds, white-faced ibis, and other colonial nesting birds.

The Service would continue its limited aerial and ground-surveying program for migratory waterfowl.

The Service would not prepare a land protection plan that explores protection and enhancement of southern San Joaquin Valley wetlands.

Threatened and Endangered Species. Under Alternative A the Service would continue its current grazing program to improve habitat suitability for Tipton's kangaroo rat and blunt-nosed leopard lizard. The Service would continue to protect Refuge uplands from flooding by diverting Poso Creek flood flows after wetland units are filled to capacity. The Service would not prepare a land protection plan exploring habitat linkage to other natural lands in the area. Limited presence/absence surveys for Tipton's kangaroo rat, blunt-nosed leopard lizard, and San Joaquin kit fox would continue.

Riparian and Saltbush Scrub Habitat. Under Alternative A (No Action), the Service would continue to manage the existing riparian habitat but would not plant any new riparian vegetation. Furthermore, no native alkali scrub restoration would occur. The Service would continue to allow researchers to conduct research on the Refuge but would not actively pursue it.

Visitor Services. Under Alternative A the Refuge visitor services would continue unchanged. The Refuge would continue its small outreach program, which includes an annual waterfowl expo and a limited number

of presentations by refuge staff at schools, and public service and conservation group meetings. Existing hunting opportunities would be maintained including 11 spaced blinds and 2,183 acres of free roam hunt area (when all wetlands are flooded), with a maximum capacity of 153 hunters per day. The Service would also continue to maintain its existing six-mile auto tour route.

Pixley Refuge
Under Alternative A Pixley Refuge would continue to be managed as it has in the recent past. In general, management would be guided by the Master Plan adopted in 1986. The focus of the Refuge would remain the same, contribute to the recovery of targeted special status species-- the blunt-nosed leopard lizard and Tipton's kangaroo rat, and provide wintering habitat for waterfowl and sandhill cranes. Current staffing and funding needs would remain the same.

Threatened and Endangered Species. Existing habitat management practices would be continued under this alternative. Grazing would continue to be the only tool used to reduce the cover of grasses and forbs and improve habitat conditions for blunt-nosed leopard lizard and Tipton's kangaroo rat. The existing limited presence/absence surveys for threatened and endangered species would also be continued. The current number of acres owned by the Refuge would not increase, other lands within the approved boundary would not be acquired, and linkage to other natural lands south of the Refuge would not be pursued.

Riparian and Grassland Habitat. No riparian habitat expansion would occur under this alternative. A grassland management plan would not be prepared.

Migratory Birds. Under Alternative A, the Service would continue existing management of moist soil units (755 acres) to maximize swamp timothy production. Units would be flooded up in August and draw down would begin in March. Moist soils units would be irrigated once or twice in April and May to assist in the germination of swamp timothy. Each year 25 percent of the units would be burned, disked, or mowed. The Service would also continue its limited program of aerial and ground waterfowl surveys.

Visitor Services. Under Alternative A, visitor services on Pixley Refuge would remain limited. The public would continue to have year-round access to the interpretive trail and observation platform adjacent to the wetlands units. Refuge staff would also continue to offer a small number of guided tours to schools and service groups. The Refuge would continue to be closed to hunting due to its small size and sensitive resources.

Alternative B

Kern Refuge
Under Alternative B, the Refuge focus would remain the same as the 1986 master plan, to provide wintering habitat for migratory waterfowl. Management programs for migratory waterfowl would be expanded and improved under this alternative, as described below. In addition, Staffing and funding needs would increase to accommodate the changes.

Migratory Birds. The Service would use the same tools and techniques to manage moist soil units under Alternative B as it does under Alternative A. However, under Alternative B, the Service would use adaptive management to target a greater diversity of high-energy waterfowl food plants such as ammania, swamp timothy, sprangle-top, and watergrass, rather than just swamp timothy and watergrass. Two new engineering equipment operators would be hired to help maintain the Refuge's wetland habitat.

Seasonal marsh management would be the same as under Alternative A. In Addition, the Service would rehabilitate units 7 and 8 (1,150 acres) to improve habitat conditions and water management efficiency. This would involve rehabilitating interior levees; eradicating salt cedar from the units using mechanical control; and installing new water control structures.

Under this Alternative, the size of the permanent sanctuary would be reduced from 3,023 acres to 2,531 acres. The first 1,000 acres of wetlands to be flooded would be closed to public use. As the remaining wetlands are flooded, 70 percent would be open and 30 percent would be closed.

The Service would discontinue maintenance of summer water in the eastern portion of unit 1 for colonial nesting species and reduce the density of the vegetation to improve habitat conditions for waterfowl.

The aerial surveying program would be expanded in the Tulare Basin to better track waterfowl population trends.

The Service would prepare and implement a land protection plan that explores protection and enhancement of Tulare Basin wetlands and associated uplands.

Threatened and Endangered Species. Under Alternative B, the Refuge would manage threatened and endangered species according to current practices described under Alternative A.

Riparian and Saltbush Scrub Habitat. In addition to current management practices described under Alternative A, the Service would plant and maintain seven acres of new riparian habitat under Alternative B, along the canal west of Unit 14 in conjunction with the moist soil expansion. However, no native alkali scrub restoration would occur under this alternative. The Service would continue to allow researchers to conduct research on the Refuge but would not actively pursue it.

Visitor Services. Under Alternative B, the Service would improve and expand visitor services on Kern Refuge with a focus on hunting. The hunting program on the Refuge would be substantially expanded by opening an additional 187 acres (Unit 6b) to free-roam hunting and 1,330 acres (Units 5a, 5b, 6a, and 6c) to hunting from 18 new designated blinds. In addition to the current hunt days—Wednesdays and Saturdays—the Refuge would be opened to hunting on Sundays. The Service would also hire a full time law enforcement officer to protect public safety enforce wildlife laws.

Under this alternative, the current limited outreach program would be expanded by developing a Refuge friends group. In addition, the number of Refuge presentations held at schools, public events, and public service and conservation group meetings, would increase. The Service would purchase new Refuge displays for use at these events.

Under Alternative B, the environmental education and interpretation programs would be expanded. A visitor services plan would be developed and implemented and a full time outdoor recreation planner would be hired (shared with Pixley Refuge). The Service would also seek to establish new partnerships with educational institutions and local organizations for environmental education on the Refuge. In addition, new educational materials would be developed.

Under this Alterative, the Service would also survey, identify, and evaluate cultural and historic sites within planned development areas. The Service would also create and utilize a Memorandum of Agreement with Native American groups to implement the inadvertent discovery clause of the Native American Graves Protection and Repatriation Act.

Pixley Refuge

Under Alternative B, the focus of Pixley Refuge would remain much the same as described under Alternative A, with improved and expanded management programs for threatened and endangered species, migratory birds, and riparian communities.

Threatened and Endangered Species. Under Alternative B, existing habitat management practices would be continued. Grazing would continue to be used to reduce the cover of grasses and forbs and improve habitat conditions for blunt-nosed leopard lizard and Tipton's kangaroo rat. Surveying and monitoring

programs for special status species would be improved and expanded under this alternative. In addition, the remaining natural lands within the approved refuge boundary would be acquired from willing sellers.

Migratory Birds. The Service would use the same tools and techniques to manage moist soil units under Alternative B as it does under Alternative A. Under Alternative B, however, the Service would use adaptive management to provide migratory birds with a greater diversity of high-energy waterfowl food plants such as ammania, swamp timothy, sprangle-top, and millet, rather than just providing swamp timothy and millet. The aerial surveying program for waterfowl would be expanded in the Tulare Basin to better track species population trends.

Riparian and Grassland Habitat. Under Alternative B, the Service would plant five acres of riparian vegetation along the service ditch between the north and south wetland units.

Visitor Services. Under Alternative B, the Service would improve and expand visitor services on Pixley Refuge with a focus on outreach and environmental education. The current limited outreach program would be expanded by developing a Refuge friends group. In addition, the number of Refuge presentations held at schools, public events, and public service and conservation group meetings would increase.

Under Alternative B, the environmental education programs would be expanded. A visitor services plan would be developed and implemented and a full time outdoor recreation planner would be hired (shared with Kern Refuge). The Service would also seek to establish new partnerships with educational institutions and local organizations for environmental education on the Refuge. In addition, new educational materials would be developed.

Alternative C

Kern Refuge

Under Alternative C, the Refuge focus would be to provide wintering habitat for migratory birds and contribute to the recovery of targeted special status species. Under this alternative, management programs for migratory waterfowl, colonial nesting birds, threatened and endangered species, riparian communities, and native uplands would be expanded and improved. In addition, opportunities for hunting, wildlife observation, photography, environmental education, and interpretation would be improved and expanded from the present conditions. Staffing and funding needs would increase to accommodate the changes.

Migratory Birds. Management and rehabilitation of moist soil and seasonal marsh units would be the same as Alternative B, with the following exceptions.

- Unit 7b would be rehabilitated as a managed seasonal marsh (in addition to units 7 and 8)
- The ratio of open to closed habitat would be the same as under Alternative A. The first 1,000 acres of wetlands to be flooded would be closed to public use; as the remaining wetlands are flooded, 45 percent would be open and 55 percent would be closed. After unit 14 is completely developed, the area of permanent sanctuary would total 3,504 acres.
- The Service would continue maintenance of summer water in the eastern portion of unit 1 for colonial nesting species.
- The Service would eradicate 90 percent of the salt cedar occurring in the seasonal marsh units within five years, using flooding and mechanical removal that could involve digging, mowing, and disking.
- The Service would expand its surveying program to include monthly waterfowl surveys of the southern San Joaquin Valley from September to March, and biweekly ground surveys of shorebirds, waterbirds, and raptors from September to June).
- The Service would also prepare a land protection plan that explores protection and enhancement of Tulare Basin wetlands and associated uplands.

Threatened and Endangered Species. Under Alternative C, the Service would continue to use cattle grazing in the 2,377-acre upland area to control the accumulation of thatch and provide suitable habitat for the blunt-nosed leopard lizard and Tipton kangaroo rat. Plant cover would be periodically monitored using average residual dry matter calculations and cattle stocking rates would be adjusted accordingly. The Service would also develop and implement a grassland management plan that would explore various options (different grazing regimes) for managing plant cover and improving habitat conditions for blunt nosed leopard lizard and Tipton kangaroo rat.

Riparian and Saltbush Scrub Habitat. In addition to the current riparian habitat management practices described under Alternative A, the Service would plant and maintain 15 acres of new riparian habitat under Alternative C, along the canal west of unit 14 in conjunction with the ongoing moist soil expansion. Herbicides (imazapyr and glyphosate) would be used to treat salt cedar through foliar spray or cut stump application with a goal of removing 90 percent within 10 years. In addition, the Service would restore 400 acres of saltbush scrub in unit 13.

Visitor Services. Visitor services would be improved and expanded under Alternative C. For example, hunting opportunities would be increased by opening an additional 540 acres (Units 5a and 5b) to hunting, and constructing nine new hunting blinds. Other major new visitor services projects under this alternative include: developing new interpretive signs and displays, and a new refuge brochure; enhancing the pond at the refuge entrance and constructing a new kiosk and boardwalk; constructing a new 4.3-mile tour route (open every day); and constructing two new photo blinds. In addition, the Service would hire a full time outdoor recreation planner and a full time law enforcement officer.

Pixley Refuge

Under Alternative C, the focus of Pixley Refuge would remain the same as described in Alternative A, with improved and expanded management programs for threatened and endangered species, migratory birds, and riparian communities.

Threatened and Endangered Species. Under Alternative C, the Service would continue to use grazing to improve habitat conditions for Tipton kangaroo rat and blunt-nosed leopard lizard. In addition, the Service would prepare a grassland management plan and conduct habitat management research to better define the habitat needs of these species. The Service would also substantially expand its surveying, monitoring, and research programs for special status species and prepare a comprehensive surveying and monitoring plan.

Migratory Birds. Management of moist soil units under Alternative C, would be the same as Alternative B. Botulism control practices would be the same as Alternative A. In addition, a 272-acre grain unit would be developed on the Turkey Tract to provide forging habitat for sandhill cranes and geese. Both aerial surveys for waterfowl and ground surveys of shorebirds, waterbirds, and raptors would be expanded under this alternative.

Riparian and Saltbush Scrub Habitat A grassland restoration and management plan would be prepared. Approximately ten acres of riparian vegetation would be planted on the north levee and along the service ditch that supplies water to the wetland units.

Visitor Services. Alternative C includes the same visitor services improvements as Alternative B. In addition, a new wildlife viewing area and interpretive displays would be constructed on the Turkey Tract adjacent to State Highway 43. The displays would focus on sandhill crane ecology and wildlife friendly farming.

Alternative D

Kern Refuge

This alternative changes the Refuge focus to maximizing native biodiversity and contributing to the recovery of targeted special status species. It also focuses on non-consumptive visitor services (wildlife observation, photography, environmental education, and interpretation. Staffing and funding needs would increase to accommodate the changes.

Migratory Birds. The management of moist soil units would be substantially modified to maximize diversity of native food plants and improve habitat for shorebirds. In addition, the Service would attempt to mimic historic hydrologic conditions by continuously fluctuating water levels in the moist soil units between zero and eight inches in winter and early spring. The size of the closed zone would be increased to 5,140 acres of permanent sanctuary.

Threatened and Endangered Species. Habitat management for threatened and endangered species would be the same as Alternative C.

Riparian and Saltbush Scrub Habitat. Management under this alternative would be the same as Alternative C, except more riparian habitat would be restored (30 acres).

Visitor Services. Major new programs under this alternative would be the same as Alternative C, with the following exceptions: an additional 7.4-mile auto tour route would be constructed, and the free roam hunt area would be reduced by 47 percent from 2,183 acres to 1,165 acres. The Refuge would continue to be open to hunting on Wednesdays and Saturdays only.

Pixley Refuge

The focus of Pixley Refuge would change under Alternative D to contributing to the recovery of targeted special status species and maximizing native species diversity.

Migratory Birds. The management of moist soil units would be substantially modified to maximize diversity of native food plants and improve habitat for shorebirds.

Threatened and Endangered Species. Management of the Pixley Refuge uplands for threatened and endangered species would be the same as Alternative C.

Riparian and Saltbush Scrub Habitat. Grasslands would be managed the same under Alternative C and Alternative D. Approximately 20 acres of riparian vegetation would be planted on the north levee and along the service ditch that supplies water to the wetland units.

Visitor Services. Alternative D includes the same visitor services improvements as Alternative C. In addition, a new parking lot off Road 83 and vernal pool foot trail in the Two Well Tract would also be developed.

Chapter 3. Affected Environment

Chapter 3 of the CCP provides a detailed description of the affected environment for both Kern and Pixley Refuges.

Chapter 4. Environmental Consequences

This chapter describes the direct, indirect, and cumulative environmental impacts of the four alternatives described in Chapter 2. Alternative A, the No Action Alternative, is a continuation of current management practices; it serves as the baseline against which Alternatives B, C, and D are compared. Mitigation measures are included at the end of each section, if required.

Impacts associated with water supply for the Refuges are described in the Final Environmental Assessment for Refuge Water Supply, Long Term Water Supply Agreements for the Tulare Basin (Bureau of Reclamation and Service 2001). Impacts associated with water conveyance to the Refuges are described in the Environmental Assessment and Initial Study, Conveyance of Refuge Water Supply, South San Joaquin Valley Study Area (Bureau of Reclamation and DFG 2003).

The four alternatives for managing Kern and Pixley Refuges will make small but important contributions to wildlife conservation, biodiversity, and threatened and endangered species recovery in the southern San Joaquin Valley. However, they do not offset the massive losses of natural plant communities and wildlife in the Tulare Basin that have occurred over the last 150 years (see Chapter 3 in the CCP). Therefore, the cumulative beneficial effects of habitat management and restoration actions described in the alternatives are not expected to have a significant effect on the quality of the human environment.

The following sections address environmental impacts by resources area.

Soils

Kern Refuge

Alternative A. Under Alternative A the Service would complete the rehabilitation of Unit 14. Construction activities could result in large areas of bare soil that could be subject to erosion. However, because construction will occur during the dry season, the terrain is flat, and the dust control practices used, any erosion is expected to be minor and localized.

Alternative B. In addition to the potential soil impacts related to rehabilitation of Unit 14, Alternative B could also result in similar construction-related impacts to due the rehabilitation of Units 7 and 8 and riparian restoration near unit 14. These impacts are also expected to be minor and localized for the same reasons described above.

Alternatives C and D. In addition to the soils impacts described under Alternative B, Alternative C also includes other Refuge improvements that could result in the same type of impacts: restoration of 440 acres of alkali sink scrub in Unit 13; mechanical removal of salt cedar from the seasonal marsh, riparian, and upland units; strengthing levees around Unit 14, and construction of a new dike across Unit 1. These impacts are also expected to be minor and localized for the same reasons described above.

Pixley

Alternative A. No impacts on soils are anticipated under Alternative A.

Alternative B. No impacts on soils are anticipated under Alternative B.

Alternative C. Under Alternatives C, the Service would pursue acquisition of the remaining undeveloped lands within the approved refuge boundary. Of these undeveloped lands, about 340 acres are considered Farmland of Statewide Importance by the California Department of Conservation. As of 2000, there were 393,036 acres of Farmland of Statewide Importance in Tulare County. If all 340 acres were purchased, retired, and restored to native uplands, this would represent a less than one tenth of one percent loss. Furthermore, this loss would be offset by the conversion of 310-acres of nonnative grasslands in the Turkey Tract Unit to a cultivated grain field.

Alternative D. Impacts to soils under Alternative D would be the same as those described under Alternative C.

Water Quantity and Quality

Kern Refuge

Alternative A. No impacts on water quality are anticipated under Alternative A.

Alternatives B, C, and D. Under Alternatives B, C and D, the Service would plant 7 to 30 acres of riparian vegetation along the canal east of unit 14. Plantings would occur during the winter when the canal is full. As a result, soils disturbed during the planting could enter the canal and temporarily increase its turbidity. However, since the water in the canal is not flowing, any sediment suspended in the water will drop out quickly. As a result, this impact is not considered significant.

Pixley Refuge

Alternative A. No impacts on water quality are anticipated under Alternative A.

Alternative B, C, and D. Under Alternative B, the Service would plant 5 to 20 acres of riparian vegetation along the canal that supplies the wetland units and along the south, west, and north edges of the wetland units. Plantings would occur during the winter when the canal is full. As a result, soils disturbed during the planting could enter the canal the wetland cells adjacent to the restoration area and temporarily increase its turbidity. However, since the water in the canal is not flowing, any sediment suspended in the water will drop out quickly. As a result, this impact is not considered significant.

Air Quality

Kern Refuge

Alternative A. Implementation of Alternative A (No Action Alternative) would not substantially increase pollutant emissions related to Refuge management and use. Visitor use levels and vehicular trips to and from the Refuge are expected to increase only moderately as the population of the surrounding region grows. In addition, no significant construction projects are proposed under this alternative.

Alternatives B, C, and D. Under Alternatives B, C, and D, both 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 organic gases) would result from projects which disturb the soil and/or require the use of heavy equipment including: rehabilitation of units 7, 7b, and 8; restoration of saltbush scrub vegetation in unit 13; and construction of new auto tour routes. Tailpipe emissions (ROG, NO_X, and PM10) would result from the use of combustion engines in construction equipment and employee vehicles during trips to and from the job site. Dust emissions would result from the excavation, transport, and grading of large amounts of soil.

Long-term increases in emissions would result from the growing number of vehicular trips to, from, and on the Refuge as visitation increases. This increase is expected to be similar under all three action alternatives (about 9,000 more visitors per year by 2,018).

Prescribed fire is another potential source of PM10 emissions. Under Alternatives B, C, and D, fire would be used on a limited basis to control vegetation in the wetland units, as described in the Refuge's Fire Management Plan. Additional details will be provided in the Prescribed Fire Plan prepared prior to each burn. The Prescribed Fire Plan would describe: the year's burn unit(s) and their predominant vegetation; the primary objectives of the unit(s) and the fire(s); the acceptable range of results; site preparation requirements; weather requirements; safety considerations and measures to protect sensitive features; burn-day activities; communications and coordination for burns; ignition technique; smoke management procedures; and post-burn monitoring.

Burning vegetation could temporarily increase PM10 concentrations in the area. The Smoke Management section of each year's Prescribed Fire Plan will include estimates of total fuel consumed (in tons/acre), emissions in pounds/acre, and total emissions (for entire burn) (in pounds). The estimates will be based on empirical factors relating particulate matter emissions to fuel type (in pounds/ton) and estimated fuel loading and nature of fuels present in each burn unit, and assume 100% consumption. Before conducting a burn, the Service will be required to obtain a burn permit from the San Joaquin Valley Unified Air Pollution Control District; in addition, separate NEPA review may be required for prescribed burns. If necessary, appropriate mitigation measures will be developed and incorporated into burn permits and NEPA review based on site- and burn-specific parameters.

In the context of current poor air quality conditions in the San Joaquin Valley air basin and likely worsening in the future due, and with the mitigation measures described below, the minor emission increases caused by Refuge activities under these alternatives would not be considered significant.

Pixley Refuge

Alternative A. Implementation of Alternative A (No Action Alternative) would not substantially increase pollutant emissions related to Refuge management and use. Visitor use levels and vehicular trips to and from the Refuge are expected to increase only moderately as the population of the surrounding region grows. In addition, no significant construction projects are proposed under this alternative.

Alternatives B, C, and D. Under Alternatives B, C, and D, increases in short and long-term emissions are expected. The sources of the emissions are similar to those described previously under Kern Refuge. These include ROG, NO_X, and PM10 emissions from the use of combustion engines in construction equipment and employee vehicles during trips to and from the job site; PM10 emissions would also result from the excavation, transport, and grading of soil. Long-term increases in emissions would result from the increasing number of vehicular trips to and from the Refuge as visitation increases. These predicted increases in visitation range from 1,100 visits per year under alternative B, to 3,000 visits per year under Alternative C. Another long-term source of PM10 emissions at Pixley Refuge under Alternatives C and D would be the agricultural operations (disking) on the Turkey Tract grain unit.

In the context of current poor air quality conditions in the San Joaquin Valley air basin and likely worsening in the future due, and with the mitigation measures described below, the minor emission increases caused by Refuge activities under these alternatives would not be considered significant.

Mitigation

Under each alternative, the Service would implement the following dust control measures, in compliance with San Joaquin Valley Unified Air Pollution Control District (APCO) rules 8021 and 8061:

- On each day that 75 or more vehicle trips will occur on an unpaved road segment, the owner/operator shall limit Vehicle Dust Emissions (VDE) to 20 percent opacity from the unpaved road segment by application and/or maintenance of at least one of the following control measures: watering; applying a uniform layer of washed gravel; applying a chemical/organic dust suppressant; using vegetative materials; paving; and any other method that effectively limits VDE to 20 percent opacity; or, by implementing an APCO approved Fugitive PM10 Management Plan as specified in Rule 8011.
- On each day that 100 or more vehicle trips will occur on an unpaved road segment, the owner/operator shall limit VDE to 20 percent opacity and comply with the requirements of a stabilized unpaved road surface by the application and/or maintenance of at least one of the following control measures: watering; applying chemical/organic stabilizers/suppressants in accordance with the manufacturer's specifications; using road mix; paving; and any other method that results in a stabilized unpaved road surface; or, by implementing an APCO-approved Fugitive PM10 Management Plan as specified in Rule 8011 (General Requirements).

The following control measures would be implemented for construction, excavation, and other earth moving activities:

- Pre-Activity: (1) pre-water site sufficient to limit VDE to 20 percent opacity, and (2) phase work to reduce the amount of disturbed surface area at any one time.
- During Active Operations: (1) apply water or chemical/organic stabilizers/suppressants sufficient to limit VDE to 20 percent opacity; or (2) construct and maintain wind barriers sufficient to limit VDE to 20 percent opacity and use control measure (1); (3) Apply water or chemical/organic stabilizers/suppressants to unpaved haul/access roads and unpaved vehicle/equipment traffic areas sufficient to limit VDE to 20 percent opacity and meet the conditions of a stabilized unpaved road surface.
- Temporary Stabilization During Periods of Inactivity: (1) Restrict vehicular access to the area; and (2) apply water or chemical/organic stabilizers/suppressants, sufficient to comply with the conditions of a stabilized surface. If an area includes 0.5 acres or more of disturbed surface area and it remains unused for seven or more days, the area must comply with the conditions for a stabilized surface area as defined in Rule 8011.

Mitigation measures, including smoke management practices, applicable to prescribed fire would be detailed in the prescribed fire plan prepared before each fire.

Plant Communities

Kern Refuge

Alternative A. Under Alternative A (no action), current vegetation management would continue unchanged. The Service would continue to burn, mow, disc, or use herbicides to manage vegetation in about 25 percent of the moist soil units each year to reduce the cover of emergent vegetation and encourage the growth of annuals that provide food for waterfowl. The same techniques would be used periodically to reduce the cover of emergent vegetation in seasonal marsh units. In addition, under Alternative A, the Service would complete the rehabilitation of Unit 14, a 1,200-acre moist soil wetland. The Service would also continue seasonal irrigation of the riparian vegetation in unit 9 to maintain it. Grazing would be used on the Refuge uplands to reduce the cover of nonnative annual grasses.

Alternative B. Alternative B would include the same vegetation management measures as described under Alternative A. In addition, the Service would rehabilitate seasonal marsh units 7 and 8 by repairing and/or replacing dikes, replacing water control structures, and mechanically removing salt cedar. This would increase the cover of native seasonal marsh plants on the Refuge. The Service would also plant five acres of riparian vegetation on the east side of Unit 14. This would have a small beneficial effect on local and regional biodiversity because most of the riparian vegetation in the Tulare Basin and the rest of the Central Valley has been lost or degraded.

Alternative C. Impacts under Alternative C would be similar to those described under Alternative B, with a few differences. Under Alternative C, the Service would also rehabilitate unit 7b, which would increase the cover of native marsh vegetation on the Refuge. Under this Alternative, the Service would use herbicides (imazapyr and glyphosate) to treat salt cedar in all riparian and upland units with a goal of removing 90 percent with ten years. Mechanical removal and flooding would be used to eradicate salt cedar from seasonal marsh units with a target of removing 90 percent within five years. This would have a beneficial effect on the Refuge's vegetation because it would improve the cover of native plant species. However, both herbicides are broad-spectrum and could effect non-target plants through drift and runoff (both herbicides), or leaching from the roots of treated plants (imazapyr only) (Tu *et al*. 2001). These potential effects would be minimized by closely following label application instructions.

Alternative C, the Service would plant riparian vegetation on 15 acres around unit 14 (rather than five acres under Alternative B). In addition, the Service would restore 440 acres of saltbush scrub in Unit 13. Both of these projects would make a small beneficial effect on local and regional biodiversity because both of these plant communities have been eliminated from most of their historic range (San Joaquin Valley Drainage Program 1990).

Alternative D. The impacts on plant communities under Alternative D would be the same as those described under Alternative C, with one exception. Under Alternative D, the Service would plant riparian vegetation on 30 acres around unit 14 (rather than 15 acres under Alternative C) and would make a greater contribution to local and regional biodiversity.

Pixley Refuge

Alternative A. The Service would continue current vegetation management practices under Alternative A. For example, about 25 percent of the moist soil units would be burned, mowed, disked, or sprayed with herbicide, to reduce the cover of emergent vegetation and encourage the growth of annuals that provide food for waterfowl. In addition, the Service will continue to use grazing on Pixley Refuge's uplands to control the growth of nonnative annual grasses.

Alternative B. Effects on plant communities under Alternative B would be the same as Alternative A. In addition, the Service would plant five acres of riparian vegetation along the service canal in the wetlands unit. This would have a small beneficial effect on local and regional biodiversity because most of the riparian vegetation in the Tulare Basin and the rest of the Central Valley has been lost or degraded.

Alternative C. The impacts on plant communities under Alternative C would be the same as those described under Alternative B, with a few exceptions. Under Alternative C, the Service would plant 10 acres of riparian vegetation in the wetlands unit (rather than 5 acres under Alternative B), thereby making a greater contribution to local and regional biodiversity. In addition, under Alternative C, the Service would develop a 272-acre grain unit on the Turkey Tract, an area currently dominated by nonnative annual grasses. Non-native grassland is relatively common in the Tulare Basin so this impact is not considered significant.

Alternative D. The impacts on plant communities under Alternative D would be the same as those described under Alternative C, with one exception. Under Alternative D, the Service would plant 20 acres of riparian vegetation in the wetlands unit (rather than 10 acres under Alternative C) thereby making a greater contribution to local and regional biodiversity.

Wildlife

Kern Refuge

Alternative A. Under Alternative A, current management of the Refuge would continue unchanged. The Refuge would continue to provide 1,200 acres of high quality moist soil habitat and 3,800 acres of seasonal marsh for migratory waterfowl, shorebirds, and other water birds through water management and periodic vegetation management. In addition, the Service would complete the rehabilitation of Unit 14 to provide an additional 1,200 acres of moist soil habitat. The Service would also continue to maintain water in the eastern portion of Unit 1 to improve habitat quality for colonial nesting water birds.

Under this alternative, the Service would continue to maintain 450 acres of riparian habitat on the Refuge with periodic flood irrigation. This would benefit the variety of wildlife that use this habitat, including raptors, songbirds, and colonial nesting birds such as the great blue heron. The Refuge would also continue to use livestock grazing in the uplands on the west side of the Refuge to improve habitat conditions for the Tipton kangaroo rat and blunt-nosed leopard lizard.

Recreational use of the Refuge is expected to increase gradually as the population of the southern San Joaquin Valley grows. Most of these new users are expected to participate in wildlife observation, primarily along the auto tour route. This growth in recreational use could adversely affect birds using the Refuge wetlands, resulting in flushing, disruption of feeding and roosting, increased demands on the birds' available energy, and reduced use of preferred habitat (DeLong 2002).

Under all alternatives, the Service would continue to allow the Kern Mosquito Vector Control District (KMVCD) to monitor and control mosquitoes on the Refuge. The typical monitoring and control period is

April through November. The mosquito species targeted on the Refuge are *Culex erythrothorax*, *C. pipiens*, *C. tarsalis*, *Orahlerdatus dorsalis*, *O. melanimon*, *O. nigromaculis*, and *Aedes vexans*. The agent used most frequently by the KMVCD to treat mosquitoes on the Refuge is *Bacillusthuringiensis israelensis* (Bti). The bacterium Bti is a microbial insecticide that, when ingested, is toxic to mosquitoes, black flies and several other members of the nematocera suborder within the order diptera. Methoprene, an insect growth regulator, is also used. It interferes with the normal maturation process of mosquitoes.

The intact Bti toxin is not active against vertebrates (Boisvert and Boisvert 2000). The greatest susceptibility are within a few families of invertebrates: culicidae (mosquitos), simuliidae (black flies) and chironomidae (midges); with mosquitoes and black flies being the most susceptible (Boisvert and Boisvert 2000). Laboratory and field studies have shown that Bti is toxic to some larval chironomids, but many factors, such as temperature, water depth, aquatic vegetation, and suspended organic matter, reduce its toxicity to chironomids in the environment (Charbonneau *et al*. 1993; Merritt et al. 1989). Chironomids are an important part of the diet of pintail and green-winged teal at Kern Refuge, especially after January (Euliss and Harris 1993). However, during the fall and early winter when most mosquito control on Kern Refuge occurs, pintail and teal feed mostly on seeds.

Methoprene kills mosquito larvae during emergence. However, it is not as specific as Bti (Breaud *et al*. 1977). Studies have shown deleterious effects of methoprene on aquatic beetles (Norland and Mulla 1975), and backswimmers (Miura and Takahashi 1974), but low toxicity to other organisms such as zooplankton (Niemi et al. 1999; Miura and Takahashi 1973).

Alternative B. Alternative B would result in mostly beneficial and some adverse impacts on wildlife. The effects on wildlife under this alternative would be the similar to those described under Alternative A, with the following exceptions.

- Under Alternative B, the Service would rehabilitate the seasonal marsh units 7 and 8 by repairing and/or replacing dikes, replacing water control structures, and mechanically removing salt cedar. This could result in the temporary disturbance and/or displacement of wildlife in these units. However, once the rehabilitation work is completed, there would be a long-term benefit to waterfowl, shorebirds, and other waterbirds due to improved habitat quality.
- The Service would stop maintaining water in Unit 1 during the summer under this alternative. This could have a long-term adverse effect on tricolor blackbirds, white-faced ibis, and other marsh-nesting birds because they may abandon nesting in Unit 1. Loss of this important nesting area could reduce regional population levels. This is a potentially significant impact. However, without summer water, which limits access to the eastern portion of Unit 1, the Service could better manage the dense vegetation in this area and improve habitat quality for waterfowl.
- The Service would plant five acres of riparian vegetation along the east side of Unit 14. Once established, this new habitat would provide a long-term benefit to a variety of wildlife including migratory songbirds and raptors.
- The Service would substantially expand the hunt program under Alternative B, with 5,600 hunters expected to visit the Refuge each season (2,800 hunters are expected under Alternative A). Furthermore, the sanctuary area would be substantially reduced from 3,946 acres under Alternative A to 2,465 acres under Alternative B. Potential impacts of this increased hunting pressure include flushing of birds, disruption of feeding and roosting activity, reduced use of preferred habitat, increased demands on birds' available energy, crippling of birds, and mortality of non-target birds (DeLong 2002). Nevertheless, the remaining sanctuary is believed to be adequate to maintain wintering waterfowl populations on the Refuge (
- The take of migratory waterfowl is expected to almost double under this alternative to about 14,000 ducks per season. This is a little over one percent of the total ducks harvested State-wide each year. Because the Refuge's estimated harvest is relatively small compared to the total harvest state-wide, this impact is not considered significant.

Alternative C. Alternative C would result in mostly beneficial and some adverse impacts on wildlife. The effects on wildlife under this alternative would be the similar to those described under Alternative A, with the following exceptions.

- Under Alternative C, the Service would rehabilitate the seasonal marsh units 7, 7b and 8 by repairing and/or replacing dikes, replacing water control structures, and mechanically removing salt cedar. This could result in the temporary disturbance and/or displacement of wildlife in these units. However, once the rehabilitation work is completed, there would be a long-term benefit to waterfowl, shorebirds, and other waterbirds due to improved habitat quality.
- The Service would use mechanical removal and flooding to eradicate salt cedar from seasonal marsh units with a target of removing 90 percent within five years. Herbicides (imazapyr and glyphosate) would be used to treat salt cedar from all riparian and upland units with a goal of removing 90 percent within ten years. Although salt cedar provides habitat for some wildlife, most researchers have concluded that it has little value to most native amphibians, reptiles, birds, and mammals (Lovich and de Gouvenain 1998). This would have a beneficial effect on the Refuge's wildlife because it would improve the cover of native plant species that are higher value to native wildlife. Both herbicides are of relatively low toxicity to birds, mammals, and fish (Tu *et al*. 2001).
- The Service would plant 15 acres of riparian vegetation along the east side of Unit 14. Once established, this new habitat would provide a long-term benefit to a variety of wildlife including migratory songbirds and raptors. In addition, the Service would restore 400 acres of saltbush scrub vegetation in Unit 13 which would benefit a variety of upland birds, including quail and mourning dove.
- Finally, the Service would expand the hunt program, and expand and improve programs for wildlife observation, photography, environmental education, and interpretation. As a result, Refuge visitation is expected to increase substantially to 15,500 visits per year. This is 80 percent more visits than expected under Alterative A. The hunt program would be expanded under this alternative, with 3,600 hunters expected to visit the Refuge each season (2,800 hunters are expected under Alternative A). Furthermore, the sanctuary area would be reduced from 3,946 acres under Alternative A to 3,431 acres under Alternative C. Potential impacts from this increased use are described under Alternative B. Furthermore, construction of the new tour route under this alternative could temporarily disturb and/or displace wildlife that use the levees and adjacent seasonal marsh.
- The take of migratory waterfowl is expected to increase by about 30 percent under this alternative to about 10,000 ducks per season. This is less than one percent of the total ducks harvested State-wide each year. Because the Refuge's estimated harvest is relatively small compared to the total harvest state-wide, this impact is not considered significant.

Alternative D. Alternative D would result in mostly beneficial effects with some adverse effects on wildlife. Impacts under this alternative would be similar to those described under Alternative C, with the following exceptions.

- Under Alternative D, the Service would attempt to mimic historic hydrologic conditions by continuously fluctuating water levels in the moist soil units between zero and eight inches in winter and early spring. This would improve habitat conditions for migrating shorebirds because shallow water habitat is in short supply during this period (Page and Shuford 2000).
- Under this Alternative, the Service would plant 30 acres of riparian vegetation, the largest amount of all the alternatives. This would provide a greater benefit to the variety of wildlife that use this plant community, including migratory songbirds and raptors.
- Finally, the Service would scale back the size of the hunt program to about, 2,500 visits per year. Furthermore, the sanctuary area would be increased from 3,946 acres under Alternative A to 4,811 acres under Alternative D. However, other visitor services would be expanded and improved, including wildlife observation, photography, environmental education, and interpretation. As a result, Refuge visitation is expected to increase substantially to 16,500 visits per year. This is double the number of visits expected under Alterative A. Potential impacts from this increased use are described under Alternative B. Furthermore, construction of two new tour routes under this alternative could temporarily disturb and/or displace wildlife that use the levees and adjacent seasonal marsh. The take of migratory waterfowl is expected to decrease by about 10 percent under this alternative.

Pixley Refuge

Alternative A. Under Alternative A, current management of Pixley Refuge would continue unchanged. The Refuge would continue to use livestock grazing in the grasslands to improve habitat conditions for the Tipton kangaroo rat and blunt-nosed leopard lizard. In addition, the Refuge would continue to provide 756 acres of high quality moist soil habitat for migratory waterfowl, shorebirds, and other water birds through water management and periodic vegetation management.

Recreational use of the Refuge is expected to increase gradually as the population of the southern San Joaquin Valley grows. Most of these new users are expected to participate in wildlife observation. This growth in recreational use could adversely affect birds using the Refuge wetlands, resulting in flushing, disruption of feeding and roosting, increased demands on birds' available energy, and reduced use of preferred habitat (DeLong 2002).

Under all alternatives, the Service would continue to allow the Tulare Mosquito Abatement District (TMAD) to monitor and control mosquitoes on Pixley Refuge. The potential impacts of mosquito control on wildlife are described in the discussion under Kern Refuge, Alternative A.

Alternative B. Effects on wildlife under Alternative B would be similar to Alternative A, with a few exceptions. Under Alternative B, the Service would pursue acquisition of the remaining natural lands within the approved Refuge Boundary from willing sellers. Once these lands are acquired, they would be protected from future development in perpetuity. This would benefit the wide variety of wildlife that inhabits these grasslands including the endangered blunt-nosed leopard lizard and Tipton kangaroo rat. The Service would also plant five acres of riparian vegetation along the service ditch between the wetland units. Once established, this new habitat would provide a long-term benefit to a variety of wildlife including migratory songbirds and raptors and amphibians.

Under Alternative B, Refuge visitation is expected to increase substantially to 1,200 visits per year. This is 145 percent more visits than expected under Alterative A. Potential impacts of this increased use include flushing of birds, disruption of feeding and roosting activity, increased energetic costs, and reduced use of preferred habitat (DeLong 2002). However, because most of the wetland unit will remain a sanctuary closed to all public use, birds will be able to avoid the disturbance by temporarily retreating to sanctuary units. As a result, this impact is not considered significant.

Alternative C. Effects on wildlife under Alternative C would be similar to Alternative B with the following exceptions. Under this alternative, the Service would develop a 272-acre grain and pasture unit in the Turkey Tract unit. This area is currently densely vegetated with nonnative grasses and forbs and has a low wildlife value. However, once developed, this area would provide a long-term benefit to sandhill cranes and geese by providing a dependable food source in close proximity to the wetland unit. The Service would also restore more riparian habitat under Alternative C (ten acres) than Alternative B (five acres) and would thus provide a greater benefit to the variety of wildlife (raptors, songbirds, amphibians, etc) which use this important habitat type.

Under Alternative C, Refuge visitation is expected to increase substantially to 3,000 visits per year. Even though this is over 300 percent more visits than expected under Alterative A, the number of visitors is relatively small when spread throughout the year. Potential impacts of this increased use would be similar to those described under Alternative B. Furthermore, construction of a new interpretive pullout at the Turkey Tract could temporarily disturb and/or displace wildlife that use the area.

Alternative D. Alternative D would also have mostly beneficial and some adverse effects on wildlife. Effects under this alternative would be similar to Alternative C, with three exceptions. Under Alternative D, the Service would attempt to mimic historic hydrologic conditions by continuously fluctuating water levels in the moist soil units between zero and eight inches in winter and early spring. This would improve

habitat conditions for migrating shorebirds because shallow water habitat is in short supply during this period (Page and Shuford 2000).

Under this Alternative, the Service would also plant more riparian vegetation (20 acres) than the other alternatives. This would provide a greater benefit to the variety of wildlife that use this plant community, including migratory songbirds, raptors, and amphibians.

Under Alternative D, Refuge visitation is expected to increase substantially to 3,500 visits per year. This is 400 percent more visits than expected under Alterative A. Potential impacts of this increased use would be similar to those described under Alternative B. Furthermore, construction of a new parking lot and vernal pool trail temporarily disturb and/or displace wildlife that use the area.

Special Status Species

This section describes the effects of the alternatives on special status species that are known to occur on Kern and/or Pixley Refuges.

Kern Refuge

Alternative A. Under Alternative A (No Action), continuation of current management activities will have beneficial effects on special status species. For example, the Service would continue to use grazing in the Research Natural Area to control nonnative grasses and to provide more open habitat suitable to the endangered blunt-nosed leopard lizard, Tipton kangaroo rat and the proposed threatened mountain plover. These uplands and associated sensitive species would continue to be protected from flooding by keeping excess water from entering the Refuge after the wetlands are filled to capacity. Under Alternative A, the Buena Vista Lake shrew is expected to benefit from the continued periodic flood irrigation that maintains the riparian habitat in units 4a, 5a, and 9. The Service would continue to manage a 300-acre portion of Unit 1 for colonial nesting species by maintaining dense emergent vegetation and keeping it flooded throughout the summer. This is expected to benefit tricolored blackbird (a bird of conservation concern) by making their nests less vulnerable to predation.

Under Alternative A, recreational use of the Refuge is expected to increase over time as the population of the southern San Joaquin Valley grows. The endangered blunt-nosed leopard lizard could be affected by the increase in visitors because it is active during the day and could be vulnerable to encounters with automobiles and other vehicles along the tour route. However, most Refuge visitors come during the cold fall and winter months when leopard lizards are inactive. The San Joaquin kit fox and Tipton kangaroo rat are both active at night when the Refuge is closed. As a result, these listed species would not likely be adversely affected.

Alternative B. Implementing Alternative B would result in both beneficial and adverse effects on special status species. Blunt-nosed leopard lizard, Tipton kangaroo rat, and mountain plover would continue to benefit from the Service's efforts to improve the quality of upland habitat through grazing and flood protection. Under Alternative B, the Buena Vista Lake shrew is expected to benefit from the periodic flood irrigation that maintains the riparian habitat in units 4a, 5a, and 9. In addition, the Service's restoration of five acres of riparian habitat on the east side of unit 14 would increase the area of suitable habitat for this imperiled species. Under this Alternative, the Service would discontinue management of a 300-acre portion of unit 1 for colonial nesting. As a result, the tricolored blackbird may abandon nesting in the marsh because their nests would be vulnerable to coyote predation (Beedy and Hamilton 1997). This could adversely affect the tricolored blackbird, a bird of conservation concern, because Kern Refuge has provided important nesting habitat for these species.

Alternative C. Alternative C, would have beneficial effects on special status species. Blunt-nosed leopard lizard, Tipton kangaroo rat, and mountain plover would continue to benefit from the Service's efforts to improve the habitat quality of the uplands through grazing and flood protection. Alternative C would increase the flood protection for special status species in the uplands by strengthening the levees around

units 11, 12, and 14. In addition, the blunt-nosed leopard lizard and Tipton kangaroo rat may benefit when the Service restores 400 acres of saltbush scrub vegetation in unit 14, an area that is currently unsuitable habitat for these species. Under Alternative C, the Service would also significantly expand monitoring and research of special status species. Information gained from this research could improve management for these species in the future.

Habitat for the blunt-nosed leopard lizard and Tipton kangaroo rat may be affected when the Service rehabilitates units 7, 7b and 8 by repairing cross levees, replacing water control structures, and removing salt cedar, to increase the efficiency with which these units can be flooded. Even though these seasonal wetland units have been flooded annually since 1995 (D. Hardt, pers. com.), approximately 100 acres of higher ground in unit 8, and 200 acres in unit 7, are flooded only occasionally and support upland vegetation. These small, isolated upland areas may have provided marginal habitat for the blunt-nosed leopard lizard and Tipton kangaroo rat in the past. However, they have been inundated occasionally during larger flood events, such as the one that occurred in 1998. As a result, the blunt-nosed leopard lizard and Tipton kangaroo rat are no longer expected to inhabit this area and would not likely be adversely affected by the proposed rehabilitation project.

Under this alternative, the Buena Vista Lake shrew is expected to benefit from the periodic flood irrigation that maintains the riparian habitat in units 4a, 5a, and 9. In addition, the Service's restoration of 15 acres of riparian habitat on the east side of unit 14 would increase the area of suitable habitat for this imperiled species.

Alternative D. Effects on special status species under Alternative D would be the same as those described under Alternative C, with a one exception. Under Alternative D, the Service would plant 30 acres of riparian vegetation around unit 14 (rather than 15 acres as proposed in Alternative C) and would thus provide more habitat for the Buena Vista Lake shrew.

Pixley Refuge

Alternative A. Under Alternative A (No Action), continuation of current management activities will have beneficial effects on special status species. For example, the Service would continue to use grazing on the Refuge's grasslands to control nonnative grasses and to provide more open habitat suitable to the endangered blunt-nosed leopard lizard and Tipton kangaroo rat. In addition, the Service would continue to manage the moist soil wetland units to provide wintering habitat for sandhill cranes, including a species State-listed as threatened, the greater sandhill crane.

Alternative B. In addition to the beneficial effects of ongoing management described under Alternative A, the Service would implement a few new projects that would benefit special status species. Under Alternative B, the Service would pursue acquisition of the approximately 3,200 acres of remaining undeveloped lands within Pixley Refuge's approved boundary from willing sellers. This habitat protection effort would contribute to the recovery of blunt-nosed leopard lizard, Tipton kangaroo rat, and San Joaquin kit fox by permanently protecting habitat from development and linking disconnected tracts of existing Refuge land.

Under Alternative B, the Service would also plant and maintain five acres of riparian vegetation along the service ditch running between the moist soil units. This riparian vegetation, once established, could provide habitat for the endangered Buena Vista Lake shrew.

Alternative C. Alternative C would result in the same beneficial effects for special status species as Alternative B. In addition, under Alternative C, the Service would prepare a grassland management plan and substantially expand surveying, monitoring, and research for Tipton kangaroo rat, blunt-nosed leopard lizard, and San Joaquin kit fox. Information gained through these activities could help improve management for these imperiled species in the future. Under Alternative C, the Service would plant and maintain ten acres of riparian vegetation, rather than five acres as proposed in Alternative B, thereby

creating more habitat for the Buena Vista Lake shrew. The Service would also develop a 272-acre grain unit on the Turkey Tract. This new grain unit, by providing foraging habitat in close proximity to the moist soil units, is expected to benefit the greater sandhill crane, State-listed threatened species.

Alternative D. Under Alternative D, the effects on special status species would be the same as described in Alternative C, with the following exceptions. First, the Service would plant 20 acres of riparian vegetation under Alternative D rather than 10 acres under Alternative C, thus providing more habitat for the Buena Vista Lake shrew. Second, the Service would develop a parking lot and vernal pool foot trail in the Two Well Tract. This area is known habitat for three listed species, the blunt-nosed leopard lizard, Tipton kangaroo rat, and vernal pool fairy shrimp. Trail and parking lot would be developed on existing disturbed areas to avoid affecting these species or their habitat.

Diseases and Toxins

The potential effects of diseases and toxins would be similar under all alternatives. Under each alternative, the Service would continue current botulism control practices, including keeping most units dry between the first of June 1 and the first of August; patrolling historically problematic wetlands on the Refuges and in the surrounding areas in cooperation with the California Department of Fish and Game; and removing sick birds and carcasses from wetlands. As a result, the potential for an outbreak of botulism would be minimized.

Under all alternatives the Service would continue to prohibit the use of lead shot at Kern Refuge for waterfowl hunting as it has for the past 12 years.

Cultural Resources

All of the alternatives for Kern and Pixley Refuges, including the No Action Alternative, have the potential to disturb cultural resources. The nature and degree of the impacts would depend on the specific activities undertaken, the nature of the resource(s) present, and the nature of previous management activities on the site and severity of any previous impacts. All ground-disturbing activities will require review by the Service's Regional Archaeologist, who will determine appropriate procedures to protect cultural resources and will specify any necessary mitigation, guided by the Service's Programmatic Agreement for cultural resources with the State Historic Preservation Officer (SHPO).

Under strategy 4.F.1, described in the CCP and included in all the alternatives, site-specific surveys will be conducted for potential archaeological and historic resources prior to initiating any construction projects such as roads, facilities, public use areas, and habitat projects. Refuge construction projects will be designed to avoid or minimize impacts on cultural resources. By implementing the mitigation measures described below, any potential impacts to cultural resources are expected to be less than significant.

Mitigation

All ground-disturbing activities will be coordinated with the Service's Regional Archaeologist, in order to preserve the Refuge's archaeologic and historic resources. Specific guidelines follow that may apply to Refuge activities, depending on site-specific conditions.

- Cultural resources survey by a qualified archaeologist may be required in areas where a ground-disturbing activity or prescribed burning is proposed. If burning is proposed entirely within a flood zone or in a previously disked or plowed area, or if burning has been an ongoing practice on the site, a cultural resources survey may not be required. However, cultural resources surveys will likely be necessary for all burns on upland sites, and for burns that require excavation (scraping, plowing, or disking) to establish a fire line. In some cases, it may be appropriate to conduct cultural resources survey work after a prescribed burn is completed, because the visibility of artifacts or other resources may be increased after burning, and artifacts may be more vulnerable to vandalism or theft when exposed by burning.

- As required by the Native American Graves Protection and Repatriation Act (NAGPRA) (25 USC 3001 et seq. or 43 CFR 10), any construction or ground-disturbing activity on the Refuge with the potential to disturb human remains, burial objects, sacred objects, or objects of cultural patrimony will be planned and implemented in consultation with affected Tribes.
- If potentially significant artifacts are found during any activity on the Refuge, work will cease within 100 feet of the find, and access will be restricted until a qualified archaeologist, and members of local Tribes can assess the significance of the find and propose appropriate methods of treatment, as required by NAGPRA.
- If human remains are found during any activity on the Refuge, work will cease within 100 feet of the find, access will be restricted, and the Kern or Tulare County Coroner will be informed of the discovery, as required under Public Resources Code Section 5050.5. If no investigation of the cause of death is required, remains will be treated in accordance with the requirements of NAGPRA.

Visitor Services

Kern Refuge

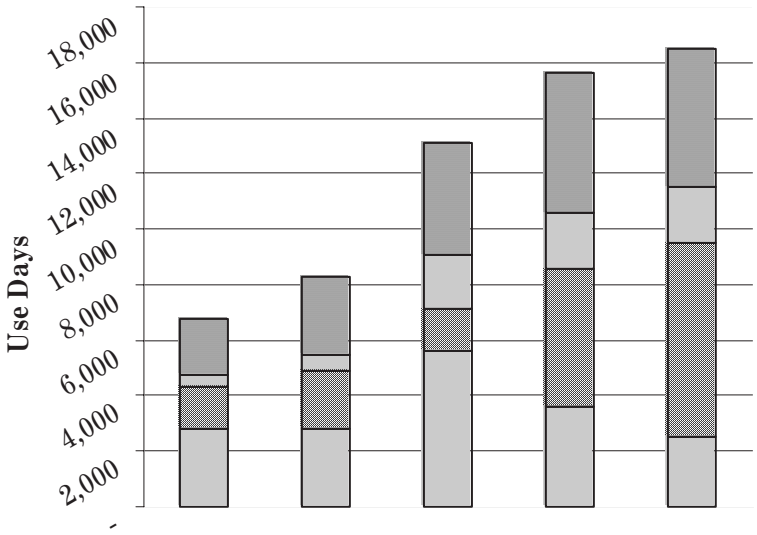
Alternative A. Under the No Action Alternative, the Service would maintain current Refuge visitor services and facilities. Therefore, there would be no effects on visitor services under this alternative. However, overall Refuge use is expected to increase as the population of the southern San Joaquin Valley and the rest of the State continues to grow over the next 15 years. According to California State Department of Finance projections, the population of the southern San Joaquin Valley (Kern, Tulare, and Kings Counties) is expected to grow by 38 percent between 2005 and 2020. The State as a whole is expected to grow by 24 percent over the same period. In the western states region, participation in hunting is predicted to decline by 21 percent between 1995 and 2020. Participation in nonconsumptive recreation is expected to increase 37 percent over the same period (Cordell et al. 1999). However, these regional trends may not necessarily reflect what is happening on a local scale. For example, waterfowl hunter use days at Kern Refuge have remained the same or increased for four out of the past five years while State-wide waterfowl hunter use days have declined for four out of the past five years (DFG 2003).

For purposes of this alternative, we assume that hunter use will remain the same over the life of the CCP and nonconsumptive recreation will increase at a rate proportional to the predicted population growth for the three-county southern San Joaquin Valley Region. Currently, Kern Refuge receives about 7,000 visits per year. Under Alternative A, the Refuge is expected to receive 8,400 visits annually by 2020. These increases in visitor use Alternative A serve as a baseline with which to compare the action alternatives. Figure 6 shows the current public use levels and predicted use levels under each alternative.

Alternative B. Alternative B would improve and expand visitor services on Kern Refuge with a focus on hunting. The hunting program on the Refuge would be substantially expanded by opening an additional 187 acres to free-roam hunting and 1,330 acres to hunting from 18 new blinds. In addition to Wednesdays and Saturdays, the current hunt days, the Refuge would be opened to hunting on Sundays. Alternative B would also expand the environmental education and interpretation programs on the Refuge and a full time outdoor recreation planner would be hired.

Under Alternative B, visitation to the Refuge is expected to increase substantially over the 15-year life of the CCP, to about 13,000 visits per year. This is over 50 percent more visits than expected under Alternative A. Nearly 60 percent of the increased visits under Alternative B would be due to expansion of the hunt program. The remaining visitor growth is expected due to the expanded environmental education and interpretation programs. However, visitation for wildlife observation and photography would decline under Alternative B, due to the proposed closure of the auto tour route on weekends throughout the hunt season (the tour route is currently closed only on Saturdays).

Figure 6. Kern Refuge: Current and Projected Visitation (15 years)



	Current	Alt A	Alt B	Alt C	Alt D
Interpretation	2,000	2,800	4,000	5,000	5,000
Environmental Education	450	600	2,000	2,000	2,000
Wildlife Observation and Photography	1,500	2,100	1,500	5,000	7,000
Hunting	2,800	2,800	5,600	3,600	2,500

Alternative C. Under Alternative C, the Service would improve and expand all visitor services on the Refuge. Hunting opportunities would be increased by opening an additional 540 acres to free roam hunting and constructing nine new hunting blinds. Other major visitor services projects proposed under this alternative include: developing new interpretive signs and displays; publishing a new refuge brochure; enhancing the pond at the refuge entrance; constructing a new kiosk and boardwalk; constructing a new 4.3-mile tour route to be open every day; and constructing a new photo blind.

Visitation to the Refuge under Alternative C, is expected to increase substantially over the 15-year life of the CCP, to about 15,500 visits per year. When compared to the current number of visitors, described under Alternative A, this is an increase in refuge visits of more than 80 percent. Approximately 10 percent of this growth would be attributed to increases in hunting, with 20 percent due to environmental education, 30 percent due to interpretation visits, and 40 percent due to wildlife observation and photography.

Alternative D. Alternative D would improve and expand visitor services on Kern Refuge with an emphasis on non-consumptive uses. Major new visitor services projects under this alternative would include: developing new interpretive signs and displays; publishing a new refuge brochure; enhancing the pond at the refuge entrance; constructing a new kiosk and boardwalk; constructing a 4.3-mile auto tour route to be open every day and a 7.4-mile auto tour route to be open on non hunt days; and constructing a new photo blind. Under Alternative D, the hunt program would be substantially reduced by eliminating about 47 percent of the free roam hunt area.

Visitation to the Refuge under Alternative D, is expected to increase substantially over the 15-year life of the CCP, to about 17,000 visits per year. This is almost 100 percent more visits than expected under the no action alternative (Alternative A). Despite the overall increase in visitation anticipated under Alternative D, it is predicted that the number of hunting visits would decline by more than 10 percent due to the reduction in the size of the hunt area proposed.

Pixley Refuge

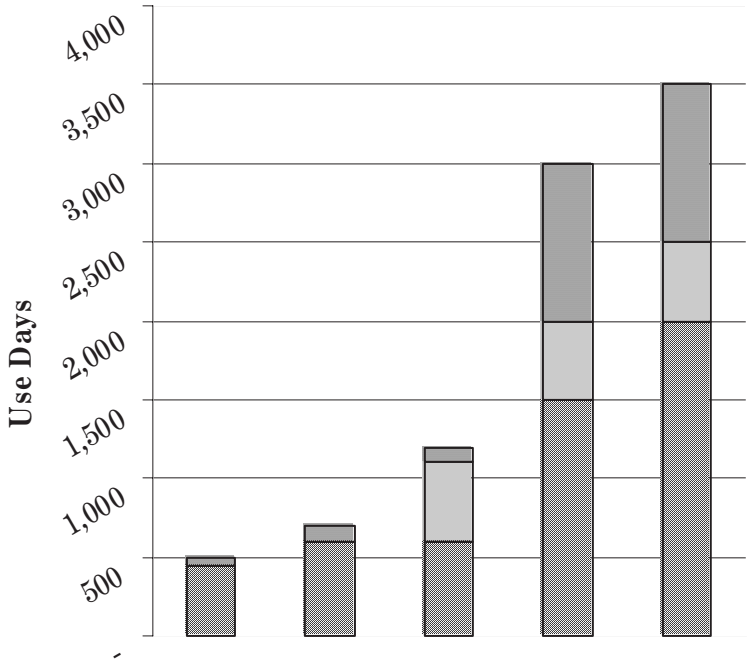
Alternative A. The Service would maintain current visitor services and facilities under the No Action Alternative. Therefore, this Alternative would have no effects on visitor services. However, Pixley Refuge visitation is expected to increase as the population of the southern San Joaquin Valley grows (see discussion under Kern Refuge, Alternative A). For purposes of this Alternative, we assume that visitation will increase at a rate proportional to the predicted population growth for the three-county southern San Joaquin Valley Region. Currently, Pixley Refuge receives about 500 visits per year. Under Alternative A, the Refuge is expected to receive about 700 visits annually by 2020. Figure 7 shows the current public use levels and predicted use levels for Pixley Refuge under each alternative.

Alternative B. Under Alternative B, the outreach and environmental education programs would be improved and expanded. The current limited outreach program would be expanded by developing a Refuge friends group and Refuge staff would give more presentations about the Refuge at schools, public events, and public service and conservation group meetings. A visitor services plan would be developed and implemented and a full time outdoor recreation planner would be hired (shared with Kern Refuge). The Service would also seek to establish new partnerships with educational institutions and local organizations for environmental education on the Refuge. In addition, new educational materials would be developed.

Under Alternative B, the number of visitors to Pixley Refuge is expected to increase over the 15-year life of the CCP, to 1,200 visits per year. This is almost 70 percent more visits than expected under Alternative A.

Alternative C. Alternative C would include the same visitor services improvements as Alternative B. In addition, a wildlife viewing area and interpretive displays would be constructed on the Turkey Tract adjacent to State Highway 43. Under this alternative, the number of visitors to Pixley Refuge is expected to increase

Figure 7. Pixley Refuge: Current and Projected Visitation (15 years)



	Current	Alt A	Alt B	Alt C	Alt D
Interpretation	40	100	100	1,000	1,000
Environmental Education	-	-	500	500	500
Wildlife Observation and Photography	450	600	600	1,500	2,000

substantially over the 15-year life of the CCP to 3,000+ visits per year. This is over 300 percent more visits than expected under Alternative A.

Alternative D. Alternative D would include the same visitor services improvements as Alternative C. In addition, a parking lot and vernal pool foot trail would be developed at the Two Well Tract. Under this alternative, the number of visitors to Pixley Refuge is expected to increase substantially over the 15-year life of the CCP, to 3,500 visits per year. This is over 300 percent more visits than expected under Alternative A.

Socioeconomics

Kern Refuge

Alternative A. Under the No Action Alternative, current management practices would continue and no change in Refuge staffing would be required. The No Action Alternative would thus have no impact on local employment conditions or the local economy.

Alternatives B, C, and D. Under Alternatives B, C, and D, wildlife management and visitor services programs would expand. This would require the Service to increase the staff of the Refuge by a maximum of three full-time employees (shared with Pixley Refuge). In addition, Refuge visitation under Alternatives B, C, and D is expected to increase substantially over the life of the CCP. This increase could benefit the local economy and local employment conditions if Refuge visitors patronized local businesses such as gas stations, restaurants, hotels, and sporting good stores. No projects proposed under any of the Alternatives would have a negative impact on low-income or minority populations.

Pixley Refuge

Alternative A. Under the No Action Alternative, current management practices would continue and no change in Refuge staffing would be required. The No Action Alternative would thus have no impact on local employment conditions or the local economy.

Alternatives B, C, and D. Socioeconomic effects under Alternatives B, C, and D would be the same as those described under Kern Refuge. In addition, the Service would pursue acquisition of the remaining 3,215 acres of undeveloped lands within the approved boundary from willing sellers. Although land acquired by the Service would be removed from the tax rolls, Tulare County would receive annual revenue sharing payments. These are equal to one of the following, whichever is largest: 75 cents per acre; three-quarters of one percent of the fair market value; or twenty-five percent of net refuge receipts. The market value is updated every five years. If refuge receipts are insufficient to allow full payment, the disbursement may be reduced proportionally. Congress may appropriate additional funds to ensure full payments.

Appendix 1: Alternatives-Goals, Objectives, and Strategies

Kern Refuge

Goal 1. Provide high quality wintering and migratory habitat for migratory birds in the southern San Joaquin Valley, with an emphasis on waterfowl and waterbirds.

Objective 1.A: Of the 6,700 acres that can be managed as seasonal wetlands, the Service would manage ***1,200*** acres (2,400 acres with moist soil expansion) for a plant cover of approximately 60 percent emergent vegetation and 40 percent open water flooded to less than 8 inches to maximize seed availability for wintering and migratory dabbling ducks and to provide invertebrate substrate with sparse vegetation and water depths of less than 2 inches for shorebirds during the following spring migration (March to May). Plant composition will consist of 50 percent or more of ***high energy*** waterfowl food plants (ammannia, swamp timothy, sprangle-top, and barnyard grass).

Alternative				Objective Targets
A	B	C	D	
1,200	***1,200***	***1,200***	***1,200***	Acres of moist soil habitat.
high energy	***high energy***	***high energy***	***native***	Waterfowl food plant composition target
				Strategies
✓	✓	✓	✓	1.A.1 Assuming water is available, begin flooding moist soil units in August. The Refuge would begin drawing down units in March
		✓	✓	1.A.2 Stagger floodup of moist soil units
			✓	1.A.3 Continuously fluctuate water levels between 0 and 8"
✓	✓	✓	✓	1.A.4 Irrigate units once or twice in April and May to assist waterfowl food plant germination.
✓	✓	✓		1.A.5 Each year, 25 percent of the units would receive one or more of the following vegetation treatments: burning, disking, mowing, or herbicide.
			✓	1.A.6 Each year, 25 percent of the units would receive one or more of the following vegetation treatments: burning, disking, or mowing.

Rationale: Dabbling ducks prefer to feed in shallow water, between 2 to 10 inches deep, with an equal ratio of open water and emergent vegetation (USFWS 1988a). In general, pintail and green-winged teal at Kern Refuge use open water areas during the day and areas with dense emergent food plants at night (Euliss and Harris 1987). Shorebirds feed on mudflats and very shallow water habitats (less than 2 inches deep) with sparse vegetation (USFWS 1992). Pintail and green-winged teal are opportunistic foragers and generally shift their food habits throughout the season to the most available foods. Pintail and teal eat mostly seeds during fall. As the season progresses, the percentage of invertebrates in their diets increases, accounting for about 60 percent of food eaten during January and February (Eulis and Harris (1987). A high diversity of food plants would provide balanced nutrition for waterfowl. Shorebirds feed primarily on invertebrates (USFWS 1992). The percentage cover targets in this objective are an average for all units.

Objective 1.B: Within 5 years the Refuge would develop ***1,200*** acres within Unit 14 as moist soil habitat to provide habitat for wintering and migratory dabbling ducks and spring-migrating shorebirds.

Alternative				Objective Targets
A	B	C	D	
1,200	***1,200***	***1,200***	***1,200***	Acres of new moist soil habitat.
				Strategies
✓	✓	✓	✓	1.B.1 Rehabilitate interior and exterior levees of Unit 14.
✓	✓	✓	✓	1.B.2 Eradicate salt cedar from the unit using mechanical and chemical methods.
✓	✓	✓	✓	1.B.3 Recontour soils on Unit 14 to improve capacity and flood up/draw down efficiency.
✓	✓	✓	✓	1.B.4 Install new water control structures.

Rationale: Pre-irrigated agricultural croplands were once the main source of habitat in the southern San Joaquin Valley for pintails arriving between August and September. However, between 1976 and 1987, the area of pre-irrigated croplands declined by 60 percent (Barnum and Euliss 1991). Developing Unit 14 as a moist soil unit would replace some of this lost habitat and increase the Kern Refuge's carrying capacity for wintering and migratory dabbling ducks and spring-migrating shorebirds. Additionally, since the increased water allocations established by the CVPIA will be available to the Refuge in 2002, completing this project would allow the Refuge to meet the CVPIA obligations.

Objective 1.C: Of the 6,700 acres of seasonal wetlands, the Refuge would manage ***3,800*** acres for a plant cover with 45 to 55 percent as emergent vegetation (cattails, hardstem bullrush) flooded less than 4 feet deep to provide foraging and loafing habitat for wintering and migratory habitat for waterfowl.

Alternative				Objective Targets
A	B	C	D	
3,800	***3,800***	***3,800***	***3,800***	Acres of seasonal marsh habitat.
				Strategies
✓	✓	✓	✓	1.C.1 Flood up the units sequentially, beginning in mid-August and finishing by mid-December
✓	✓	✓	✓	1.C.2 Begin drawing down the units by mid-June.
✓	✓	✓		1.C.3 Use burning, mowing, discing and herbicide as needed to achieve the targeted plant cover.
			✓	1.C.4 Use burning, mowing, and discing, as needed to achieve the targeted plant cover.
		✓	✓	1.C.5 Within 5 years, eradicate 90 percent of the existing acreage of salt cedar from seasonal wetland units.
	✓	✓	✓	1C.6 Rehabilitate Units 7 and 8 by reconstructing existing dikes or constructing new dikes to improve water management efficiency.

Rationale: Deeper wetland habitats provide foraging and feeding sites for diving ducks (USFWS 1993). This type of habitat, equally interspersed with tall emergent vegetation (cattail and hardstem bulrush), provides excellent habitat for cover and loafing for a variety of waterfowl.

Objective 1.D: Of the 3,800 acres of marsh habitat, the Refuge would manage up to ***300*** acres for a plant cover of 75 percent flooded 1 to 2 feet deep from mid-March to July to provide nesting habitat for tri-colored black birds and white-faced ibis.

Alternative				Objective Targets
A	B	C	D	
300	***0***	***300***	***300***	Acres of seasonal marsh habitat with summer water.
				Strategies
✓	✓	✓	✓	1.D.1 Retain 1-2 feet of water in the eastern portion of Unit 1 until July
		✓	✓	1.D.2 Construct and maintain a new dike across Unit 1 to improve water management flexibility.
		✓	✓	1.D.3 Conduct two tri-colored blackbird censuses each spring in cooperation with the CDFG.
		✓	✓	1.D.4 Coordinate research and monitoring of ibis and tri-colored blackbird with CDFG
		✓	✓	1.D.5 Coordinate with Kern Mosquito Abatement District to insure that spraying does not occur when birds are nesting

Rationale: Kern Refuge has historically been an important nesting site for tri-colored blackbirds and recently for white-faced ibis. More than 10,000 blackbirds and 5,000 ibis nest in the late spring or early summer when water management objectives on the Refuge are directed at drawing water off wetlands. During this time the Refuge provides stable wetland habitat for these species which is consistent with published management recommendations (Beedy and Hamilton 1997). This action also benefits other wetland dependent wildlife.

Objective 1.E: The Refuge would minimize the occurrence, spread, and severity of botulism outbreaks.

Alternative				Objective Targets
A	B	C	D	
				same for all alternatives
				Strategies
✓	✓	✓	✓	1.E.1 Keep all units dry between June 1 and August 1 (except 300 acres of Unit 1 managed for tri-colored blackbirds.
✓	✓	✓	✓	1.E.2 Patrol historically problematic wetlands on the Refuge and in the southern San Joaquin Valley in cooperation with the CDFG to quickly identify outbreaks.
✓	✓	✓	✓	1.E.3 Remove sick and dead birds from wetlands. Sick birds would be brought to the duck hospital at Kern Refuge for rehabilitation. Carcasses would be buried.

Rationale: Type C botulism can cause major die-offs of waterbirds during the summer. Between 1969 and 1980, four major outbreaks in the southern San Joaquin Valley killed 70,700 birds. Major die-offs generally occur during the years when the valley receives flood flows from Sierran streams during the spring (D. Hardt, pers. comm..). On the Refuge, botulism can be avoided by completely draining the wetlands during the hottest period of the summer (D. Hardt, pers. comm..).

Objective 1.F: The Refuge would provide high quality resting and foraging habitat in a sanctuary for waterfowl using the following formula: (1) the first 1,000 acres of habitat would be closed to hunting; (2) the remaining wetland habitat would be opened on a ***45*** percent open, ***55*** percent closed basis (***3,504*** acres of permanent wetland sanctuary).

Alternative				Objective Targets
A	B	C	D	
45	***70***	***45***	***30***	Percent of wetland habitat open to hunting and other public uses
55	***30***	***55***	***70***	Percent of wetland habitat closed to hunting and other public uses
4,223	***2,531***	***3,504***	***5,140***	Acres of wetland sanctuary

				Strategies
✓	✓	✓	✓	1.F.1 The first 1,000 acres of wetlands flooded will be closed to hunting.
✓				1.E.2 As the remaining wetlands are flooded[1], 45 percent will be opened and 55 percent will be closed. When all Refuge wetland units are flooded, Units 1, 1A, 2, 2A, 4A, and 4B would be open to hunting and the remainder would be closed.
	✓			1.E.3 As the remaining wetlands are flooded, 70 percent will be opened and 30 percent will be closed. When all Refuge wetland units are flooded, units 1, 1A, 2, 2A, 4A, 4B, 5A, 5B, 6A, 6B, and 6C would be open to hunting and the remainder would be closed.
		✓		1.E.4 As the remaining wetlands are flooded, 45 percent will be opened and 55 percent will be closed. When all Refuge wetland units are flooded, units 1, 1A, 2, 2A, 4A, 4B, 5A, and 5B would be open to hunting and the remainder would be closed.
			✓	1.E.4 As the remaining wetlands are flooded, 30 percent will be opened and 70 percent will be closed. When all Refuge wetland units are flooded, units 1, 1A, 4A, and 4B would be open to hunting and the remainder would be closed.

Rationale: Sanctuary areas are extremely important on Refuges that allow hunting and other public uses because they provide high quality habitat for feeding, resting, and thermal protection. Without these areas, waterfowl and other wildlife species exposed to repeated human disturbances may change food habits and distribution patterns, feed only at night, lose weight, have decreased reproductive success, and/or abandon the feeding, nesting, and resting areas. Sanctuary at Kern Refuge is especially important because it attracts waterfowl away from the Tulare Lake Drainage District evaporation ponds which are immediately north of the Refuge. These ponds may contain harmful levels of contaminants including selenium.

Objective 1.G: The Refuge would conduct regular surveys of waterfowl and other migratory birds on the Refuge and in the southern San Joaquin Valley to help track their population status.

Alternative				Objective Targets
A	B	C	D	
				same for all alternatives
				Strategies
✓				1.G.1 Conduct three aerial waterfowl surveys of the southern San Joaquin Valley between October and March.
	✓	✓	✓	1.G.2 Conduct monthly aerial waterfowl surveys of the southern San Joaquin Valley from September to March.
		✓	✓	1.G.3 Conduct biweekly shorebird, waterbird, and raptor surveys from September to June.

Rationale: Regular surveys of waterfowl and other migratory birds are a critical component of the adaptive management approach proposed for these species and their habitat. These surveys, in addition to those conducted at other wildlife areas in California's Central Valley and throughout the Pacific Flyway, provide important information about species' population trends that will help determine how well our management strategies are working.

Objective 1.I: In partnership with other Federal, State, and local agencies and nongovernmental organizations, the Refuge would seek to protect and enhance up to 16,000 acres of wetlands in the southern San Joaquin Valley.

[1]Including unit 14 when rehabilitation is completed.

Alternative				Objective Targets
A	B	C	D	
n/a				same for all action alternatives
				Strategies
	✓	✓	✓	1.I.1 Within 1 year, complete and begin to implement a detailed land protection plan and EA to evaluate various land protection alternatives.

Rationale: Despite being the driest region in the Central Valley, the historic wetlands in the Tulare Basin associated with Tulare, Buena Vista, and Kern Lakes provided the largest single block of wetlands habitat in California (USFWS 1978). About 260,000 acres of permanent wetlands and an equal area of seasonal wetlands were present. Loss and modification of these native wetlands was primarily due to large scale conversion to agricultural lands (see Figure 7 in CCP) and the dramatic decline in flood flows to the Tulare Basin due to flood control projects. Today, less than 1 percent of the historic wetland acreage remains. Active and cooperative partnerships with other Federal, State, and local agencies and nongovernmental organizations would allow all of these agencies to use expertise, personnel, and funding resources to protect and enhance wetlands for migratory and resident waterfowl and waterbirds.

Goal 2. Protect, preserve, and restore valley sink scrub and grassland habitats in the southern San Joaquin Valley to contribute to the recovery plan goals for the San Joaquin kit fox, blunt-nosed leopard lizard, and Tipton kangaroo rat.

Objective 2.A: The Refuge would actively manage the ***2,377*** acres of upland vegetation to prevent excessive accumulation of mulch and growing plants to provide suitable habitat for Tipton kangaroo rat and blunt-nosed leopard lizard. The Refuge would maintain an average residual dry matter (RDM) between 750 and 800 pounds per acre in the upland areas until such time as optimum management conditions are determined through scientific research.

Alternative				Objective Targets
A	B	C	D	
2,377	***2,377***	***2,377***	***2,377***	same for all alternatives
				Strategies
✓	✓	✓	✓	2.A.1 Beginning in October of each year, periodically measure the average RDM at several locations to determine appropriate timing, duration, and stocking rates for cattle (assumptions for lbs RDM/AUM).
✓	✓	✓	✓	2.A.2 Using the stocking rates calculated in the strategy above, graze cattle in the upland areas until target RDM is reached.
		✓	✓	2.A.3 Develop cooperative land management agreements with each grazing permitee
		✓	✓	2.A.4 Develop and implement a grassland management which explores various options (grazing, prescribed fire, etc) for managing the cover of grasses and forbs. The plan would be adaptive, and would include monitoring the effects of management tools on vegetation and wildlife.

Rationale: The Tipton Kangaroo rat and blunt-nosed leopard lizard inhabit areas where the understory is dominated by nonnative annual grasses and forbs. During all but drought years, if left uncheck, these annuals form dense stands with RDM increasing each year. The Tipton kangaroo rat and blunt-nosed leopard lizard prefer sparsely vegetated areas with RDM less than 750 to 800 pounds per acre (USFWS 1998, Kelly et al. 2000).

Objective 2.B: The Service would protect Refuge uplands from Poso Creek flood flows.

Alternative				Objective Targets
A	B	C	D	
				same for all alternatives
				Strategies
✓	✓	✓	✓	2.B.1 When flood flows arrive, the Refuge would fill all wetland units to capacity.
✓	✓	✓	✓	2.B.2 When all wetland units are filled, stop inflow into Refuge.
		✓	✓	2.B.3 Strengthen levees surrounding Units 11, 12, and 14.
		✓	✓	2.B.4 Negotiate a Poso Creek flood water management agreement with adjacent landowners.

Rationale: Poso Creek flood waters discharge onto the west side of the Refuge. The inadequate levees and water control structures of Unit 14 on the west side result in sheet flooding of adjacent Refuge uplands. This occurs every 8 to 10 years, on average, the most recent being in 1998. The endangered Tipton kangaroo rat and blunt-nosed leopard lizard are intolerant of flooding (USFWS 1998) and Refuge records reflect little or no use of Refuge uplands by these two species, as well as the endangered San Joaquin kit fox, in the years following floods.

Objective 2.C: In partnership with other Federal, State, and local agencies and nongovernmental organizations, the Service would seek to establish links between Kern Refuge and other natural lands in the area including the Semitropic Ridge Natural Area, Pixley Refuge, the Allensworth Natural Area, and along Poso Creek to the Sierra foothills. Links would be established through management or conservation agreements, incentive programs, and/or acquisition from willing sellers (fee or easement).

Alternative				Objective Targets
A	B	C	D	
n/a	***n/a***	✓	✓	Establish linkages between Kern Refuge and other natural lands.
				Strategies
		✓	✓	2.C.1 Seek approval to prepare a detailed land protection plan to evaluate various land protection alternatives.
		✓	✓	2.C.2 Coordinate with ongoing habitat conservation planning efforts in Kern County.

Rationale: Currently, most protected natural lands in the San Joaquin Valley that provide habitat for Tipton kangaroo rat, blunt-nosed leopard, and San Joaquin kit fox are isolated islands surrounded by unprotected lands (See Figure 7 in CCP). Establishing links between these habitat islands would prevent genetic isolation of the listed and sensitive species that exist there (Recovery Tasks 5.1.2 and 5.1.9 in the Recovery Plan for Upland Species of the San Joaquin Valley).

Objective 2.D: In partnership with DFG and ESRP, conduct research and monitoring of special status species and their habitats as described in the Recovery Plan for Upland Species of the San Joaquin Valley.

Alternative				Objective Targets
A	B	C	D	
n/a	***n/a***	✓	✓	Monitoring and research
				Strategies
✓	✓			2.D.1 Conduct annual presence/absence surveys for listed species along established transects

		✓	✓	2.D.2 Census and monitor the following special status species in the Refuge on an annual basis: San Joaquin kit fox, Tipton kangaroo rat, blunt-nosed leopard lizard, Buena Vista Lake shrew, giant slough thistle, and recurved larkspur
		✓	✓	2.D.3 Develop and implement a comprehensive census and monitoring plan for special status species
		✓	✓	2.D.4 Investigate the following aspects of Buena Vista Lake shrew biology and ecology: habitat requirements, reproduction and demography, population genetics, effects of pesticide use and drift, and the effects of selenium
		✓	✓	2.D.6 Conduct rare plant surveys of the alkali sinks on the Refuge

Rationale: Lack of information about some species existing on Pixley Refuge can be a major impediment to successful management. The Recovery Plan for Upland Species of the San Joaquin Valley identifies a number of research needs applicable to Kern Refuge (Recovery Tasks 3.2.4, 3.2.19, 3.2.30, 4.26, 4.53, 4.56, and 4.82). Currently, the Refuge has inadequate resources (funding and staff) to conduct this research. Cooperative partnerships with other agencies, universities, and institutions could produce additional resources, enabling more research projects to be completed.

Goal 3. Restore and maintain representative examples of Tulare Basin grassland, riparian, and sink scrub habitats on Kern Refuge.

Objective 3.A: The Kern Refuge would maintain and enhance the 450-acre riparian area through regular water management to provide habitat for a high diversity of native riparian dependant species (neotropical migrants, raptors, colonial nesting birds, and small mammals).

Alternative				Objective Targets
A	B	C	D	
450	***450***	***450***	***450***	Acres of riparian habitat maintained and enhanced
				Strategies
✓	✓	✓	✓	3.A.1 Flood the riparian area in fall, winter, and early spring.
✓	✓	✓	✓	3.A.2 Flood irrigate trees once a month during the summer (June, July, and August) to maintain trees.
		✓	✓	3.A.3 Eradicate salt cedar from the riparian areas using mechanical removal, herbicide, and/or water management.

Rationale: Because nearly 90 percent of the riparian vegetation present prior to European settlement has been lost, riparian areas in the southern San Joaquin Valley are rare (Barbour et al. 1991). Riparian communities on the Refuge are used by special status species including Buena Vista Lake shrew and giant slough thistle. The large willow and cottonwood trees provide nesting habitat for great horned owls and great blue herons. The natural hydrology of the area has been dramatically altered by upstream water diversions and creek channelization. As a result, the riparian vegetation along the remnant sloughs in Units 9 and 10 and between Units 4 and 5 has no natural source of surface water to sustain it.

Objective 3.B: By 2005, the Refuge would plant and maintain 15 acres of riparian vegetation along the canals around Unit 14 to provide habitat for the Buena Vista Lake shrew, neotropical migrants birds, and colonial nesting waterbirds.

Alternative				Objective Targets
A	B	C	D	
0	***5***	***15***	***30***	Acres of riparian habitat restored.
				Strategies
	✓	✓	✓	3.B.1 Rehabilitate canal and setback levee 30 feet along canals.
	✓	✓	✓	3.B.2 Plant and maintain riparian trees, shrubs, and forbs native to the riparian forests in the area using cuttings from near by populations.
	✓	✓	✓	3.B.3 Maintain restored riparian habitat as described in Objective 3.A
		✓	✓	3.B.4 Monitor response of bird populations to riparian restoration.

Rationale: See rationale under Objective 3.A. Riparian restoration and management recommendations contained in the Riparian Bird Conservation Plan (RHJV 2000) would be used to guide riparian restoration efforts.

Objective 3.C: Within 5 years, the Refuge would restore ***400*** acres of valley sink scrub vegetation in Unit 13 to provide cover, nesting, and foraging habitat for upland migratory bird species.

Alternative				Objective Targets
A	B	C	D	
0	***0***	***400***	***400***	Acres of valley sink scrub habitat restored.
				Strategies
		✓	✓	3.C.1 Cut shallow swales through the unit.
		✓	✓	3.C.2 Prepare seed beds with light discing or other means.
		✓	✓	3.C.3 Collect, prepare, and broadcast seed.
		✓	✓	3.C.4 Irrigate unit by flooding swales.
		✓	✓	3.C.5 Monitor success (seed germination, plant growth, relative cover, etc.).

Rational: The valley sink scrub plant community occurred historically on the boarders of lakes and overflow lands of the major streams in the Tulare Basin. More than 80 percent of this community was eliminated as the valley was developed for agriculture (Werschkull et al. 1984). Alkali sink scrub provides important cover, nesting, and/or foraging habitat for a variety migratory bird species including: sage sparrow, western meadowlark, logger-headed shrike, short-eared owl, burrowing owl, and mourning dove. Resorting Unit 13 would increase the extent of this community on the Refuge by more than 50 percent.

Objective 3.D: Within 5 years of CCP completion, prepare a grassland management plan that addresses control of exotic vegetation (salt cedar, nonnative annual grasses).

Alternative				Objective Target
A	B	C	D	
		✓	✓	Prepare grassland management plan
				Strategies

		✓	✓	3.D.1 Conduct comprehensive plant and animal surveys.
		✓	✓	3.D.2 Prepare detailed GIS vegetation maps.
		✓	✓	3.D.3 Conduct literature review.
		✓	✓	3.D.4 Prepare grassland management plan in cooperation with CDFG, USGS BRD, ESRP, and university researchers.

Rationale: Currently, there is no plan that guides management of the RNA. Invasive nonnative grasses and salt cedar are problems in much of the RNA. Grazing is the only management activity currently used to manage vegetation. A management plan is needed to explore the use of other grazing regimes and new tools such as prescribed fire for managing vegetation.

Objective 3.E: The Refuge will encourage and provide opportunities for research by other agencies and universities in the region, especially as they relate to the management goals and objectives of the Refuge.

Alternative				Objective Target
A	B	C	D	
	✓	✓	✓	Encourage and provide opportunities for research.
				Strategies
	✓	✓	✓	3.E.1 Each year, update and share the Refuge research needs list with universities in the region and other agencies which conduct research.
		✓	✓	3.E.2 Refuge staff will actively participate in the San Joaquin Valley natural Communities Conference each year.

Rational: Lack of information about some species existing on Kern Refuge can be a major impediment to successful management. The Recovery Plan for Upland Species of the San Joaquin Valley identifies a number of research needs applicable to the Kern Refuge (Recovery Tasks 3.2.4, 3.2.19, 4.25, 4.52, 4.55, and 4.57). Currently, the Refuge has inadequate resources (funding and staff) to conduct this research. Cooperative partnerships with other agencies, universities, and institutions could produce additional resources, enabling more research tasks to be completed.

Goal 4. Provide visitors with wildlife-dependant recreation, interpretation, and education opportunities which foster an appreciation and understanding of Kern Refuge's unique wildlife and plant communities.

Objective 4.A: The Refuge would provide safe hunting opportunities for up to ***164*** hunters per day (depending on area of flooded wetlands) on ***Wednesdays and Saturdays*** during the hunt season. Hunters would have a reasonable chance of success in uncrowded conditions.

Alternative				Objective Targets
A	B	C	D	
136	***217***	***164***	***93***	Number of hunters accommodated per hunt day (approx 28 hunt days/year if Wed & Sat, 43 if Wed, Sat, Sun)
Wed, Sat	***Wed, Sat, Sun***	***Wed, Sat***	***Wed, Sat***	Hunt days
				Strategies
✓	✓	✓	✓	4.A.1 Provide 11 spaced blinds in Units 4A and 4B (1 handicapped-accessible) for hunter use (maximum of 4 hunters per blind).

✓	✓	✓		4.A.2 Provide 1,840 acres of free-roam hunt area in units 1, 1A, 2 and 2A. Maximum hunter density will be 1 hunter per 20 acres (maximum of 92 hunters)
			✓	4.A.3 Provide 1,000 acres of free-roam hunt area in units 1and 1A. Maximum hunter density will be 1 hunter per 20 acres (maximum of 48 hunters).
		✓		4.A.4 When Unit 14 is completely developed as a moist soil unit, provide an addition 17 spaced blinds in Units 5A and 5B (1 handicapped-accessible) for hunter use (4 hunters per blind).
	✓			4.A.5 When unit 14 is completely developed as a moist soil unit, provide an addition 18 spaced blinds in units 5A, 5B, 6A and 6C for hunter use (4 hunters per blind) and 187 acres of free roam hunting in unit 6b) (maximum of 9 hunters).
	✓			4.A.6 Work with CDFG to setup Sunday as hunt day (in addition to Wed and Sat).

Rationale: Hunting, one of the six priority public uses identified in the Refuge Improvement Act, has occurred on Kern Refuge since 1963. In this objective, "safe" means that there are no hunting-related safety incidents. "Reasonable chance of success" means that the average duck harvest per hunter visit would be greater than or equal to the State average. "Uncrowded" means that there would be no more than 1 hunter per 20 acres.

Objective 4.B: The Refuge would provide opportunities (including adequate facilities) for visitors to view, photograph, appreciate, and enjoy the Refuge's unique natural communities and wildlife during all seasons with a target of ***5,000*** visits per year by 2018.

Alternative				**Objective Targets**
A	B	C	D	
2,100	***1,500***	***5,000***	***7,000***	Number of wildlife observation visits per year
				Strategies
✓	✓	✓	✓	4.B.1 Continue to maintain the existing 6 mile tour route
	✓	✓	✓	4.B.2 Develop and implement a public use plan
		✓	✓	4.B.3 Construct new 4.3 mile tour route around unit 7(open every day). This would involve improving existing levee road to make it all weather, constructing pullouts, and installing interpretive signs along route.
		✓	✓	4.B.4 Construct a new photography blind
			✓	4.B.5 Construct new 7.4 mile tour route around units 1, 1a, 4a, and 4b (open on non-hunt days). This would involve (1) improving existing levee road to make it all weather; (2) construction of guard rails around 5 wells along southern leg of route; (3) constructing pullouts, and (4) installing signs along the route.

Rationale: Wildlife observation and photography are two of the six priority public uses identified in the Refuge Improvement Act. Currently, about 1,500 visitors per year participate in wildlife observation and photography on Kern Refuge. Most use occurs along the 5-mile self-guided auto tour route. However, the tour route is closed on hunt days (Wednesdays and Saturdays) due to safety concerns. As a result, opportunities for wildlife viewing and photography on these days are limited.

Objective 4.C: The Refuge would provide guided interpretive tours for students and members of interested organizations to develop an awareness of natural communities, wildlife, and ecology with a target of sustaining at least ***5,000*** visits per year by 2018.

Alternative				**Objective Targets**
A	B	C	D	
3,000	***4,000***	***5,000***	***5,000***	Number of interpretive visits per year

				Strategies
	✓	✓	✓	4.C.1 Develop and implement a public use plan
	✓	✓	✓	4.C.2 Develop partnerships with local school districts and other organizations to provide periodic. interpretive tours which highlight the Refuge's unique resources
		✓	✓	4.C.3 Develop new interpretive signs, displays, and a new Refuge brochure
		✓	✓	4.C.4 Develop a kiosk and a boardwalk, and enhance the pond at the Refuge entrance

Rationale: Interpretation is one of the six priority public uses identified in the Refuge Improvement Act. Interpretive activities provide the public with opportunities to be introduced to and better understand Refuge resources and their management. Currently, about 2,000 visitors per year participate in interpretive activities on the Refuge. Implementing programs with local schools and communities would provide support for the Refuge and provide an alternative environment for investigating and interpreting Refuge ecology.

Objective 4.D: The Refuge would encourage educators from the southern San Joaquin Valley to use Kern Refuge to conduct environmental education field studies that focus on the Refuge' s unique natural communities, with a target of 500 visits annually within 5 years.

Alternative				Objective Target
A	B	C	D	
550	***2,000***	***2,000***	***2,000***	Number of environmental education visits per year
				Strategies
	✓	✓	✓	4.D.1 Development and implement public use plan
	✓	✓	✓	4.D.2 Establish partnerships with educational institutions and local organizations
	✓	✓	✓	4.D.3 Add 1 FTE outdoor recreation planner
	✓	✓	✓	4.D.4 Develop educational materials

Rationale: Environmental education one of the six priority public uses identified in the Refuge Improvement Act. Currently, about 340 visitors per year participate in environmental education activities on the Refuge. Information obtained through a visit to the Refuge, as well as that presented in educational materials would provide a working foundation for environmental education in the field as well as in the classroom.

Objective 4.E: Within three years, the Refuge would participate in a minimum of ***12*** outreach activities each year.

Alternative				Objective Targets
A	B	C	D	
6	***10***	***12***	***13***	Number of outreach events per year.
				Strategies
	✓	✓	✓	4.E.1 Develop a friends group for the Refuge
✓	✓	✓	✓	4.E.2 Give presentations about the Refuge and its unique resources to schools, conservation groups, and public service organizations
✓	✓	✓	✓	4.E.3 Plan and conduct a Waterfowl Expo at Refuge each fall
	✓	✓	✓	4.E.4 Purchase general and Refuge specific displays for use at fairs, shows, and festivals
	✓	✓	✓	4.E.5 Coordinate with California Department of Transportation to develop Refuge displays for rest stops.

Rationale: The Refuge was established in 1960 under provisions of the Migratory Bird Treaty Act and has long been a haven for waterfowl hunters. While managing wetland habitat is important, the Refuge objectives and issues continue to broaden and include uplands, listed species, and non-consumptive uses. Outreach activities such participation in local and regional fairs and presentations to schools, conservation groups, and service organizations help keep potential Refuge users informed and involved in the Refuge.

Objective 4.F: Implement a proactive cultural resource management program focused on meeting the National Historic Preservation Act requirements. In addition to consultations the State Historic Preservation Officer, this would involve identifying, inventorying, evaluating, and protecting cultural resources.

Alternative				Objective Targets
A	B	C	D	
✓	✓	✓	✓	Same for all alternatives
				Strategies
✓	✓	✓	✓	4.F.1 Identify archaeological sites that coincide with existing and planned roads, facilities, public use areas, and habitat projects
	✓	✓	✓	4.F.2 Implement a program to evaluate eligibility to the NRHP those archaeological sites that may be impacted by Service projects, management activities, erosion, or neglect. Prepare and implement activities to mitigate impacts to such sites as necessary
		✓	✓	4.F.3 Develop a Geographic Information system (GIS) layer for cultural resources that can be used with other GIS layers for the Refuge, yet contains appropriate locks to protect sensitive information.
		✓	✓	4.F.4 Develop partnerships with the Tribes for inventorying, evaluating, and project monitoring for cultural resources consistent with the regulations of the National Historic Preservation Act.
			✓	4.F.5 Update and expand the 1983 Overview of Cultural Resources, Kern and Pixley Refuges, to develop a cultural resource management plan

Rationale: Various Federal historic preservation laws and regulations require the Service to implement the kind of program described under this objective. Inattention to these responsibilities may obstruct the Refuge in its other land, habitat, and wildlife management efforts.

Objective 4.G: Develop, in partnership with the Tribes and other preservation partners, a program for interpreting the cultural resources of the Refuge.

Alternative				Objective Targets
A	B	C	D	
		✓	✓	Same for all action alternatives
				Strategies
		✓	✓	4.G.1 Consult with the Tribes, historical societies, and other preservation partners to identify the type of cultural resources information appropriate for public interpretation.
		✓	✓	4.G.2 Prepare interpretive media (e.g., pamphlets, signs, exhibits) that relate to cultural resources.
			✓	4.G.3 Develop a museum property inventory. Create storage and use plans for museum property as part of the outreach program.

Rationale: Because cultural resources are not renewable, interpreting them could instill a conservation ethic among the public and others who encounter or manage them. The goals of the cultural resources interpretive program would be fourfold: (1) translate the results of cultural research into media that can be understood and

appreciated by a variety of people, (2) relate the connection between cultural resources and natural resources and the role of humans in the environment, (3) foster an awareness and appreciation of native cultures, and (4) instill an ethic for the conservation of our cultural heritage.

Objective 4.H: Create and use a memorandum of agreement with Native American groups to implement the inadvertent discovery clause of the Native American Graves Protection and Repatriation Act (NAGPRA).

Alternative				Objective Targets
A	B	C	D	
	✓	✓	✓	Same for all action alternatives
				Strategies
	✓	✓	✓	4.H.1 Identify Native American Tribes, Groups, and direct lineal descendants that may be affiliated with the Refuge lands
	✓	✓	✓	4.H.2 Open consultation process with affiliated Tribes, Groups, and direct lineal descendants
	✓	✓	✓	4.H.3 Define funerary, sacred, and cultural patrimony objects
	✓	✓	✓	4.H.4 Develop procedures to follow for intentional and inadvertent discoveries
	✓	✓	✓	4.H.5 Identify persons to contact for the purposes of NAGPRA

Rationale: Developing a Memorandum of Agreement prior to an inadvertent discovery is strongly suggested by the NAGPRA implementing regulations. Such an agreement can facilitate consultations as required by law after an inadvertent discovery.

4.2 Pixley Refuge

Goal 1: Protect, preserve, and restore alkali sink scrub, saltbush scrub, iodine bush scrub and grassland habitats in the southern San Joaquin Valley to contribute to the recovery plan goals for the San Joaquin kit fox, blunt-nosed leopard lizard, and Tipton kangaroo rat..

Objective 1.A: The Refuge would actively manage the ***4,730*** acres of upland vegetation to prevent excessive accumulation of mulch and growing plants to provide suitable habitat for Tipton kangaroo rat and blunt-nosed leopard lizard. The Service would maintain an average residual dry matter (RDM) of less than 800 pounds per acre in the upland areas until optimum management conditions are determined through scientific research.

Alternative				Objective Target
A	B	C	D	
4,730	***4,730***	***4,730***	***4,730***	Acres of upland vegetation managed for endangered species.
				Strategies
✓	✓	✓	✓	2.A.1 Beginning in October of each year, periodically measure the average RDM at several locations to determine appropriate timing, duration, and stocking rates for cattle (assumptions for lbs RDM/AUM).
✓	✓	✓	✓	2.A.2 Using the stocking rates calculated in the strategy above, graze cattle in the upland areas until target RDM is reached.
		✓	✓	2.A.3 Develop cooperative land management agreements with each grazing permitee
		✓	✓	2.A.4 Develop and implement a grassland management which explores various grazing regimes for managing the cover of grasses and forbs. The plan would be adaptive, and would include monitoring the effects of management tools on vegetation and wildlife.

Rationale: The blunt-nosed leopard lizard and the Tipton kangaroo rat inhabit areas where nonnative annual grasses and forbs dominate the understory. During all but drought years, these annuals form dense stands if left unchecked with RDM increasing each year. These two species prefer sparsely vegetated areas with RDM less than 750 to 800 pounds per acre (USFWS 1998, Kelly et al. 2000).

Objective 1.B: In partnership with CDFG and the Endangered Species Recovery Program, the Refuge would conduct habitat management studies to determine how best to manage natural lands to enhance habitat for the Tipton kangaroo rat and blunt-nosed leopard lizard.

Alternative				Objective Targets
A	B	C	D	
n/a	***n/a***	✓	✓	Conduct habitat management studies.
				Strategies
		✓	✓	2.B.1 Expand, coordinate, and continue habitat management studies in on Pixley Refuge.
		✓	✓	2.B.2 Initiate studies of competition between Tipton and Heerman's kangaroo rats, focusing primarily on how different habitat management prescriptions affect the population dynamics of the two species at sites of coexistence.

Rationale: More than 90 percent of the habitat on the Pixley Refuge is grassland composed of native and nonnative species. Grazing is currently the only management tool used to provide more open habitat for these endangered species. Additional research would provide important information related to grazing rates and duration as well as information on other management tools (mowing, burning) that may also be useful. Information from research conducted in partnership with other agencies would complement Refuge and region-wide management strategies and objectives for these endangered species (Recovery Task 4.24 in Recovery Plan for Upland Species of the San Joaquin Valley, California).

Objective 1.C: In partnership with other Federal, State, and local agencies and private landowners, the Service would seek to link and protect blocks of suitable habitat for the Tipton kangaroo rat and blunt-nosed leopard lizard in the area between and around the Pixley Refuge and the Allensworth Natural Area to minimize the effects of random catastrophic events (e.g., drought, flooding, fire) on their populations. The blocks of land should be several thousand acres each with a core area of at least 5,000 acres of high quality habitat that is not subject to over bank or sheet flooding. The core area should provide topographic and plant community diversity.

Alternative				Objective Targets
A	B	C	D	
n/a	✓	✓	✓	Link and protect blocks of suitable habitat for endangered species.
				Strategies
	✓	✓	✓	2.C.1 Acquire remaining natural lands within the approved Refuge Boundary from willing sellers.
		✓	✓	2.C.2 Seek approval to prepare a land protection plan to evaluate various land protection strategies (fee or easement acquisition of natural lands, and agricultural land retirement).

Rationale: Historically, the Tipton kangaroo rat was widely distributed in the arid portions of the Tulare Basin. By 1985, the area it inhabited had been reduced, primarily by cultivation and urbanization, to about 3.7 percent of the historical acreage (USFWS 1997). The remaining populations on small islands of protected habitat (see Figure 7 in CCP) are vulnerable to random catastrophic events (e.g., drought, flooding, fire). Protecting larger blocks of habitat would contribute to the Tipton kangaroo rat's recovery by making these populations less vulnerable to extinction. This objective would implement Recovery Task 2.1.7, 5.1.2 and 5.1.3 of the Recovery Plan for Upland Species of the San Joaquin Valley.

Objective 1.D: In partnership with DFG and ESRP, conduct research and monitoring of special status species and their habitats as described in the Recovery Plan for Upland Species of the San Joaquin Valley.

Alternative				Objective Targets
A	B	C	D	
n/a	✓	✓	✓	Conduct habitat management research.
				Strategies
✓				1.D.1 Conduct annual presence/absence surveys for SJKF, BNLL, and TKR along established transects
	✓	✓	✓	1.D.2 Census and monitor the following special status species in the refuge on an annual basis: San Joaquin kit fox, Tipton kangaroo rat, blunt-nosed leopard lizard, Buena vista Lake shrew, and recurved larkspur
		✓	✓	1.D.3 Develop and implement a comprehensive census and monitoring plan for special status species
		✓	✓	1.D.4 Investigate the following aspects of San Joaquin kit fox biology and ecology: dispersal, movements, diet, reproduction and demography, use of agricultural fields, use of artificial dens, and effects of rodenticide use
		✓	✓	1.D.5 Investigate the following aspects of Tipton kangaroo rat biology and ecology: competition with Heerman's kangaroo rat, effects of grazing, effects of fire, and reproduction and demography
		✓	✓	1.D.6 Investigate the following aspects of blunt-nosed leopard biology and ecology: competition with effects of grazing, effects of fire, and reproduction and demography
		✓	✓	1.D.7 Conduct rare plant surveys of the alkali sinks on the Refuge

Lack of information about some species existing on Pixley Refuge can be a major impediment to successful management. The Recovery Plan for Upland Species of the San Joaquin Valley identifies a number of research needs applicable to Pixley Refuge (Recovery Tasks 3.2.4, 3.2.19, 4.24, 4.25, 4.50, 4.51, 4.57, 4.77, 4.78, and 4.79). Currently, the Refuge has inadequate resources (funding and staff) to conduct this research. Cooperative partnerships with other agencies, universities, and institutions could produce additional resources, enabling more research projects to be completed.

Goal 2. Restore and maintain a representative example of Tulare Basin grassland and riparian habitat on Pixley Refuge.

Objective 2.A. The Refuge would maintain and enhance the 15-acre riparian area to provide habitat for a high diversity of native riparian dependant species (neotropical migrants, raptors, colonial nesting birds, and small mammals).

Alternative				Objective Targets
A	B	C	D	
15	***15***	***15***	***15***	Acres of riparian habitat maintained
				Strategies
✓	✓	✓	✓	2.A.1 Eradicate exotic vegetation from the riparian areas using mechanical removal or herbicide.

Rationale: Because nearly 90 percent of the riparian vegetation present in the Central Valley prior to European settlement has been lost, riparian areas in the southern San Joaquin Valley are rare (Barbour et al. 1991). The

willows along Deer Creek provide cover and nesting habitat for a variety of neotropical migratory birds and raptors.

Objective 2.B: Within 5 years, the Refuge would plant and maintain ***10*** acres of riparian forest along the service ditch and north levee of wetland cells to provide habitat for a diversity of wildlife including neotropical migratory birds, colonial nesting waterbirds, and raptors.

Alternative				Objective Targets
A	B	C	D	
0	***5***	***10***	***20***	Acres of riparian habitat restored.
				Strategies
	✓	✓	✓	2.B.1 Plant dormant pole cuttings of cottonwoods and willows during late fall and irrigate.
	✓	✓	✓	2.B.2 Flood in fall, winter, and early spring
	✓	✓	✓	2.B.3 Monthly summer irrigation (June, July, and August)
		✓	✓	2.B.4 In partnership with adjacent and upstream landowners , control salt cedar, giant reed, and other invasive species along Deer Creek using IPM approach (mechanical, chemical, and/or biological means)
		✓	✓	2.B.5 Monitor response of bird populations to riparian restoration.

Rationale: Because nearly 90 percent of the riparian vegetation present in the Central Valley prior to European settlement has been lost, riparian areas in the southern San Joaquin Valley are rare (Barbour et al. 1991). The willows along Deer Creek provide cover and nesting habitat for a variety of neotropical migratory birds and raptors.

Goal 3. Provide high quality wintering and migratory habitat for migratory birds in the southern San Joaquin Valley, with an emphasis on waterfowl, sandhill cranes, and other waterbirds.

Objective 3.A: The Refuge would manage **755** acres of moist soil units for a plant cover of more than 50 percent annuals [or high energy waterfowl food plants] flooded less than 8 inches to maximize seed availability for wintering and migrating dabbling ducks and to provide invertebrate substrate with sparse vegetation and water depths less than 2 inches for shorebirds during the following spring migration (March to May). Plant composition will consist of 50 percent or more of ***high energy*** waterfowl food plants (ammannia, swamp timothy, sprangle-top, and barnyard grass).

Alternative				Objective Targets
A	B	C	D	
755	***755***	***755***	***755***	Acres of moist soil habitat
high energy	***high energy***	***high energy***	***native***	Waterfowl food plant composition target
				Strategies
✓	✓	✓	✓	1.A.1 Assuming water is available, begin flooding moist soil units in August. The Refuge would begin drawing down units in March
		✓	✓	1.A.2 Stagger floodup of moist soil units
			✓	1.A.3 Continuously fluctuate water levels between 0 and 8"
✓	✓	✓	✓	1.A.4 Irrigate units once or twice in April and May to assist waterfowl food plant germination.

✓	✓	✓		1.A.5 Each year, 25 percent of the units would receive one or more of the following vegetation treatments: burning, disking, mowing, or herbicide.
			✓	1.A.6 Each year, 25 percent of the units would receive one or more of the following vegetation treatments: burning, disking, or mowing.

Rationale: Dabbling ducks prefer to feed in shallow water, between 2 to 10 inches deep, with an equal ratio of open water and emergent vegetation (USFWS 1988a). In general, pintail and green-winged teal at Kern Refuge use open water areas during the day and areas with dense emergent food plants at night (Euliss and Harris 1987). Shorebirds feed on mudflats and very shallow water habitats (less than 2 inches deep) with sparse vegetation (USFWS 1992). Pintail and green-winged teal are opportunistic foragers and generally shift their food habits throughout the season to the most available foods. Pintail and teal eat mostly seeds during fall. As the season progresses, the percentage of invertebrates in their diets increases, accounting for about 60 percent of food eaten during January and February (Eulis and Harris (1987). A high diversity of food plants would provide balanced nutrition for waterfowl. Shorebirds feed primarily on invertebrates (USFWS 1992). The percentage cover targets in this objective are an average for all units.

Objective 3.B: Within 5 years, the Service would develop ***272***-acres within the Turkey Tract into a grain unit to provide foraging habitat for waterfowl, sandhill cranes, and other waterbirds.

Alternative				Objective Targets
A	B	C	D	
0	***0***	***272***	***272***	Acres of grain developed in Turkey Tract
				Strategies
		✓	✓	3.B.1 Develop water delivery system from existing wetland units to the Turkey Tract.
		✓	✓	3.B.2 Develop irrigation system.
		✓	✓	3.B.3 Cultivate small grains in rotation.

Rationale: Up to 3,000 sandhill cranes each year use the moist soil habitat at Pixley Refuge for resting habitat while they forage mostly off Refuge on adjacent grain fields. In the past several years, a number of these grain fields have been lost due to the development of several large dairies and more are planned. Development of a grain unit on the Turkey Tract would provide permanent foraging habitat for the cranes adjacent to the wetland unit to replace habitat lost due to development of dairies.

Objective 3.D: The Refuge would minimize the occurrence, spread, and severity of botulism outbreaks.

Alternative				Objective Targets
A	B	C	D	
				same for all alternatives
				Strategies
✓	✓	✓	✓	1.E.1 Keep all units dry between June 1 and August 1 (except 300 acres of Unit 1 managed for tri-colored blackbirds.
✓	✓	✓	✓	1.E.2 Patrol historically problematic wetlands on the Refuge and in the southern San Joaquin Valley in cooperation with the CDFG to quickly identify outbreaks.
✓	✓	✓	✓	1.E.3 Remove sick and dead birds from wetlands. Sick birds would be brought to the duck hospital at Kern Refuge for rehabilitation. Carcasses would be buried.

Rationale: Type C botulism can cause major die-offs of waterbirds during the summer. Between 1969 and 1980, four major outbreaks in the southern San Joaquin Valley killed 70,700 birds. Major die-offs generally occur during

the years when the valley receives flood flows from Sierran streams during the spring (**?source?**). On the Refuge, botulism can be avoided by completely draining the wetlands during the hottest period of the summer (**?source?**).

Goal 4. Provide visitors with wildlife-dependant recreation, interpretation, and education opportunities which foster an appreciation and understanding of Pixley Refuge's unique wildlife and plant communities.

Objective 4.A: The Refuge would provide opportunities (including adequate facilities) for visitors to view, photograph, appreciate, and enjoy the Refuge's unique natural communities and wildlife during all seasons with a target of ***1,500*** visits per year by 2018.

Alternative				**Objective Target**s
A	B	C	D	
600	***600***	***1,500***	***2,000***	Number of wildlife observation visits per year
				Strategies
✓	✓	✓	✓	4.A.1 Continue to maintain existing viewing platform in wetland unit
		✓	✓	4.A.2 Develop and implement a public use plan
		✓	✓	4.A.3 Once Turkey Tract is fully developed, construct a pullout with signs which interpret wildlife-friendly farming for sandhill cranes and other waterbirds
			✓	4.A.4 Develop parking lot and vernal pool foot trail

Rationale: Wildlife observation and photography are two of the six priority public uses identified in the Refuge Improvement Act. Currently, about 300 visitors per year participate in wildlife observation and photography on Pixley Refuge. All use occurs along the 1.5 mile self-guided interpretive trail.

Objective 4.B: The Refuge would provide guided interpretive tours for students and members of interested organizations to develop an awareness of natural communities, wildlife, management, and ecology with a target of sustaining at least ***1,000*** visits per year by 2018.

Alternative				**Objective Target**s
A	B	C	D	
100	***100***	***1,000***	***1,000***	Number of interpretive visits per year by 2018
				Strategies
✓	✓	✓	✓	4.C.1 Continue to maintain existing 1.5 mile interpretive trail
		✓	✓	4.C.2 Develop and implement a public use plan
		✓	✓	4.C.3 Develop partnerships with local school districts and other organizations to provide periodic. interpretive tours which highlight the Refuge's unique resources

Rationale: Interpretation is one of the six priority public uses identified in the Refuge Improvement Act. Interpretive activities provide the public with opportunities to be introduced to and better understand Refuge resources and their management. Currently, about 65 visitors per year participate in interpretive activities on the Refuge. Implementing programs with local schools and communities would provide support for the Refuge and provide an alternative environment for investigating and interpreting Refuge ecology.

Objective 4.C: The Refuge would encourage educators from the southern San Joaquin Valley to use Pixley Refuge to conduct environmental education field studies that focus on the Refuge' s unique natural communities, with a target of 500 visits annually within 5 years.

Alternative				Objective Target
A	B	C	D	
0	***500***	***500***	***500***	Number of environmental education visits per year
				Strategies
	✓	✓	✓	4.D.1 Development and implement public use plan
	✓	✓	✓	4.D.2 Establish partnerships with educational institutions and local organizations
	✓	✓	✓	4.D.3 Add 1 FTE outdoor recreation planner (shared with Kern Refuge)
	✓	✓	✓	4.D.4 Develop educational materials

Rationale: Environmental education one of the six priority public uses identified in the Refuge Improvement Act. Currently, there is no environmental education program on the Refuge. Information obtained through a visit to the Refuge, as well as that presented in educational materials would provide a working foundation for environmental education in the field as well as in the classroom.

Objective 4.D: Implement a proactive cultural resource management program focused on meeting the National Historic Preservation Act requirements. In addition to consultations the State Historic Preservation Officer, this would involve identifying, inventorying, evaluating, and protecting cultural resources.

Alternative				Objective Targets
A	B	C	D	
✓	✓	✓	✓	Same for all alternatives
				Strategies
✓	✓	✓	✓	4.F.1 Identify archaeological sites that coincide with existing and planned roads, facilities, public use areas, and habitat projects
	✓	✓	✓	4.F.2 Implement a program to evaluate eligibility to the NRHP those archaeological sites that may be impacted by Service projects, management activities, erosion, or neglect. Prepare and implement activities to mitigate impacts to such sites as necessary
		✓	✓	4.F.3 Develop a Geographic Information system (GIS) layer for cultural resources that can be used with other GIS layers for the Refuge, yet contains appropriate locks to protect sensitive information.
		✓	✓	4.F.4 Develop partnerships with the Tribes for inventorying, evaluating, and project monitoring for cultural resources consistent with the regulations of the National Historic Preservation Act.
			✓	4.F.5 Update and expand the 1983 Overview of Cultural Resources, Kern and Pixley Refuges, to develop a cultural resource management plan

Rationale: Little reconnaissance or documentation has occurred on Pixley Refuge concerning historic or archaeological sites and most adjacent properties have been highly modified to meet agricultural needs. Various Federal historic preservation laws and regulations require the Service to implement the kind of program described under this objective. Inattention to these responsibilities may obstruct the Refuge in its other land, habitat, and wildlife management efforts.

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Appendix B. Wilderness Review

A wilderness review is the process used by the Service to determine whether or not to recommend lands or waters in the National Wildlife Refuge System to Congress for designation as wilderness. The Service is required to conduct a wilderness review for each refuge as part of the CCP process. Lands or waters that meet the minimum criteria for wilderness are identified in a CCP and further evaluated to determine whether they merit recommendation for inclusion in the Wilderness System.

According to Section 13 of the Service's Director's Order No. 125 (12 July 2000), in order for a refuge to be considered for wilderness designation, all or part of the refuge must:

- Be affected primarily by the forces of nature, with the human imprint substantially unnoticeable;
- Have outstanding opportunities for solitude or a primitive and unconfined type of recreation;
- Have at least 5,000 contiguous acres (2,000 ha) or be sufficient in size to make practicable its preservation and use in an unimpaired condition, or be capable of restoration to wilderness character through appropriate management, at the time of review; and
- Be a roadless island.

Kern Refuge contains a total 10,618 acres. However, it is subdivided into 14 smaller units surrounded by numerous roads and bisected by miles of cross levees. Units 11 and 12 (the San Joaquin Desert Research Natural Area) are the most natural of the Refuge units. They still contain much evidence of past human use, including dirt roads and remnants of past ranching activities. Furthermore, these units together comprise about 2,000 acres, which is smaller than the area required for designation as wilderness. For these reasons, Kern Refuge does not meet the criteria for wilderness designation.

Pixley Refuge contains a total of 6,385 acres in nine management units. The largest contiguous block of Service-owned lands is about 4,500 acres. However, this block is divided roughly in half by a county road and numerous smaller dirt roads. Pixley Refuge also contains much evidence of past and current human use, including nearly 800 acres of actively managed wetlands, and remnants of past ranching and farming activities. For these reasons, Kern Refuge does not meet the criteria for wilderness designation.

Appendix C. Landscape Level Goals

Landscape Level Goals Relevant to Kern and Pixley Refuges

CALFED Ecosystem Restoration Program

- Improve aquatic and terrestrial habitats and natural processes to support stable, self-sustaining populations of diverse and valuable plant and animal species, and includes recovery of species listed under the State and Federal Endangered Species Acts.
- Protect or restore functional habitat types throughout the watershed for public values such as recreation, scientific research, and aesthetics.
- Prevent establishment of additional non-native species and reduce the negative biological and economic impacts of established non-native species.
- Improve and maintain water and sediment quality to eliminate, to the extent possible, toxic impacts on organisms in the system, including humans.

Central Valley Habitat Joint Venture Implementation Plan

- Protect, maintain, improve, and restore habitat to increase waterfowl populations to desired levels in the Central Valley of California consistent with other objectives of the NAWMP.
- Protect 80,000 additional acres of existing wetlands through acquisition of fee-title or perpetual conservation easements.
- Secure an incremental, firm 402,450 acre-foot water supply that is of suitable quality and is delivered in a timely manner for use by the NWR's, State WA's, and the GRCD.
- Secure CVP power for NWR's, State WA's, GRCD, and other public land private lands dedicated to wetland management.
- Increase wetland areas by 120,000 acres and protect these wetlands in perpetuity by acquisition of fee-title or conservation easements.
- Enhance waterfowl wetland habitats on 291,555 acres of public and private lands.
- Enhance waterfowl habitat on 443,000 acres of agricultural lands.
- Increase waterfowl populations to desired levels: total ducks (breeding: 400,000; mallard (breeding): 300,000; total ducks (winter): 4,700,000; mallard (winter): 531,000; pintail (winter): 2,800,000; total geese and swans: 875,000; cackling Canada: 200,000; Aleutian Canada: 5,000; Lesser snow: 320,000; Ross': 100,000; tule white-fronted: 5,000; Pacific white-fronted: 200,000; tundra swan: 40,000.

Kern County General Plan Goals

- Habitats of threatened or endangered species should be protected to the greatest extent possible.
- Rivers and streams in the County are important visual and recreational resources and wildlife habitats. Areas of riparian vegetation along rivers and streams will therefore be preserved when feasible to do so.

North American Waterfowl Management Plan – 1998 Update

- Enhance the capability of landscapes to support waterfowl and other wetland-associated species by ensuring that Plan implementation is guided by biologically based planning, which in turn is refined through ongoing evaluation.
- Define the landscape conditions needed to sustain waterfowl and benefit other wetland-associated species, and participate in the development of conservation, economic, management, and social policies and programs that most affect the ecological health of these landscapes.

- Collaborate with other conservation efforts, particularly migratory bird initiatives, and reach out to other sectors and communities to forge broader alliances in a collective search for sustainable uses of landscapes.
- Maintain the current diversity of duck species throughout North America and achieve a continental breeding population of 62 million ducks during years with average environmental conditions, which would support a fall flight of 100 million.
- Attain a black duck mid-winter population index of 385,000.
- Increase or reduce goose populations to sustainable levels listed in Appendix 1.
- Reduce Western tundra swan population to 60,000, and increase Pacific Coast trumpeter swan population to 43,200.
- In the Central Valley Habitat Joint Venture Area, protect 80,000 acres, restore 120,000 acres, and enhance 735,000 acres.

Pacific Flyway Management Plan: Western Management Unit Mourning Dove Goals and Objectives

- Maintain the Western Management Unit (WMU) population of mourning doves and its habitat at levels consistent with optimum distribution, density, and recreational uses of the resources.
- Determine the causes of mourning dove population declines in the (WMU) and establish procedures to reverse the trends.
- Increase the population levels of WMU mourning doves to a point where call-count indices average no less than 16 in the Coastal subunit.
- Increase and maintain adequate habitat to sustain the current seasonal distribution of WMU mourning doves throughout their range. The important habitat components are appropriate structures for nesting and roosting (trees), and food and water sources.
- Maximize the potential for systained consumptive and non-consumptive uses of the mourning dove resource in the WMU.

Recovery Plan for Upland Species of the San Joaquin Valley, California.

- The ultimate goal of this recovery plan is to delist the 11 endangered and threatened species and ensure the long-term conservation of the 23 candidates and species of concern. An interim goal is to reclassify the endangered species to threatened status. The 11 listed species include five endangered plants (California jewelflower, palmate-bracted bird's-beak, Kern mallow, San Joaquin woolly-threads, and Bakersfield cactus), one threatened plant (Hoover's woolly-star), and five endangered animals (giant kangaroo rat, Fresno kangaroo rat, Tipton kangaroo rat, blunt-nosed leopard lizard, and San Joaquin kit fox). This plan details the recovery criteria and habitat protection, monitoring, and research priorities for each of these imperiled species.

Riparian Bird Conservation Plan (California Partners in Flight and the Riparian Habitat Joint Venture)

- Increase the breeding range of native birds and safeguard healthy bird communities with high productivity.
- Maximize riparian ecosystem health, promote a self-sustaining functioning system, and maximize the cost-effectiveness of riparian conservation activities.
- Increase the overall breeding range and/or abundance of native riparian birds by designing and implementing horticultural restoration projects that mimic natural riparian plant diversity and "patchiness". Such plantings will most quickly support a diverse community of bird species that can successfully nest in the restored habitat.
- Increase the value of existing/ongoing habitat and restoration projects for bird species.

- Ensure that large landscape-scale management and flood control projects maximize benefits to wildlife in conjunction with benefits to agriculture and urban populations. Achieving numerous goals simultaneously would maximize the overall value of such projects to the people of California.
- Implement and time land-management activities with the goal of maximizing bird species productivity or "source" populations.
- Protect, recreate, or minimize interruptions of natural processes, particularly hydrology and associated high-water events to allow/promote/facilitate the natural cycle of channel movement, sediment deposition, and scouring that results in a diverse mosaic of riparian vegetation classes.

Southern Pacific Coast Regional Shorebird Plan

- Increase the wintering population of the Mountain Plover in the Central Valley.
- Create suitable open foraging habitat by managing for giant kangaroo rats (*Dipodomys ingens*) and using fire and grazing, as appropriate.
- Increase populations of breeding and wintering Snowy Plovers and wintering Long-billed Curlews in the Central Valley.
- Increase breeding and wintering populations of other shorebirds in the Central Valley.
- Restore, enhance, and manage wetlands with integrated wetland management goals, which accommodate the needs of a greater diversity of birds, including shorebirds (Isola 1998).
- Ensure the availability of high quality water for wetlands.
- Resist fragmentation or loss of existing wetland complexes by urban encroachment.
- Promote management practices in agricultural lands and vernal pool rangelands that will provide for a greater diversity of birds, including shorebirds. Also promote easements and other options for maintaining wildlife-friendly agricultural lands and vernal pool rangelands.
- Reduce use of contaminated agricultural evaporation ponds by shorebirds and other waterbirds while creating alternative uncontaminated habitats that will mimic historic saline playa wetlands thereby maintaining the current mix of waterbird communities.
- Increase shorebird use of sewage ponds or wetlands using treated sewage effluent if issues of disease transmission and contaminants can be addressed.

USFWS/CDFG Tricolored Blackbird Status Update and Management Guidelines

- Maintain viable, self-sustaining populations distributed throughout the current range of the species.
- Avoid losses of tricolor colonies and their reproductive effort throughout their range.
- Increase the breeding opportunities on suitable public lands and on private lands managed for this species.
- Enhance public awareness and support for protection of this unique species.
- Minimize losses of important foraging habitat for both nesting and wintering populations.

Appendix D. Compatibility Determinations

Compatibility Determination

Use: Hunting waterfowl (ducks and geese), coots, moorhens, and upland game birds (ring-necked pheasant)

Refuge Name: Kern National Wildlife Refuge

Establishing and Acquisition Authorities:

The Kern National Wildlife Refuge, located in Kern County, California, was established in 1960 under provisions of the Migratory Bird Conservation Act (16 U.S.C. § 715d).

Refuge Purpose (s):

Migratory Bird Conservation Act "for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." (16 U.S.C. §71sd)

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

Description of Use: The Kern National Wildlife Refuge (Refuge) would continue to provide opportunities for hunting waterfowl (ducks and geese), coots, moorhens and upland game birds (pheasant). Hunting is identified as a priority public use of the National Wildlife Refuge System under the National Wildlife Refuge System Improvement Act of 1997. Other priority wildlife-dependent public uses identified by the Act include fishing, wildlife observation, photography, environmental education and interpretation. Hunting would be permitted on designated areas of the Refuge, pursuant to the conditions of a cooperative agreement with the State of California, Department of Fish and Game, during the established state waterfowl hunting season. This use has occurred annually since the first hunting season on the Refuge in 1963 (Kern NWRC files). The Refuge would remain closed to all other forms of hunting and target shooting.

The waterfowl hunting season typically begins the third weekend in October and continues to the third weekend in January with waterfowl hunting being allowed on the Refuge Wednesdays and Saturdays only. Shooting hours and daily limits conform to federal and State regulations. Complete copies of hunting regulations may be obtained from the Department of Fish & Game at www.dfg.ca.gov, the Kern NWR hunter check station during operational hours on Wednesdays and Saturdays or at the Kern NWR office.

Pheasant hunting will be permitted incidental to waterfowl hunting only in the free roam units and only during that portion of the state waterfowl hunting season when pheasant season is also open. While the majority of the pheasants on the refuge are found in upland areas located west of Goose Lake Canal where hunting is prohibited, pheasant hunting is only permitted within the wetlands where relatively few pheasant reside. While a limited number of pheasants are taken each year, the opportunity is there in the event that a hunter flushes a bird while walking to and from his waterfowl hunting location. The refuge does not plant pheasants on the area and all birds are wild from the self sustaining population.

A detailed discussion of the Kern NWR hunt program can be found in Chapter 3 of the Kern NWR Draft Comprehensive Conservation Plan (USFWS). Also contained in the Environmental Assessment developed for the CCP are four alternatives that describe various levels of hunting activity that range from 11 spaced blinds and 1,165 acres of free roam area to a maximum of 28 blind sites and 2,369 acres open to free roam hunting (see Figure 4 in the Draft CCP). Alternative B also proposes to add Sunday as a shoot day on the refuge. When the Draft CCP is finalized a Public Use Plan will be developed as a step down plan from the CCP that will provide updated management guidelines for operation of the refuge hunting program.

A variety of seasonal and moist soil wetlands are managed by the Refuge to provide suitable habitat for migratory and wintering waterfowl. Some of these areas will also be managed to provide hunter access into free roam units and units having designated blind sites. Each free roam unit will have an established hunter quota based on a ratio of one hunter per 20 acres of habitat. Within the spaced blind area, blinds which can accommodate up to 4 hunters per blind are established at fixed locations. The mandatory spacing and hunter quotas will help prevent overcrowding of specific areas within the hunt units on the refuge and contribute to a safer and higher quality hunting experience. Three handicapped accessible blinds will also be located in the spaced blind area. Throughout the waterfowl hunting season, new areas will be opened to hunting as additional wetland habitat is flooded on the refuge. Under ideal conditions, which depend largely on water availability and subsequent total area of flooded wetlands, the Refuge will be able to provide hunting opportunities for up to 152 hunters per day.

Designated hunting areas are delineated on refuge hunting maps and the hunt area and closed zones are posted annually with appropriate refuge signs. If new areas are added during the season, posting is changed to accommodate these modifications.

Hunting will be allowed in free roam Units 1, 1A, 2, and 2A as well as units having designated blind sites in one of 11 moist soil wetlands located in Units 4A, 4B, and 5A. These units represent approximately 2,513 acres but may vary from year to year depending upon water availability and total acres flooded.

Each blind site will be designated with a numbered post; hunters assigned to a blind must remain within 100 feet of the numbered post when engaged in shooting unless pursuing injured birds. The hunting area will be delineated annually, based on water and habitat availability, by signs and maps that are distributed to all hunters. Access will be achieved by foot or, in some units, by boats. The use of non-motorized boats supports free roam hunters in deep water areas such as Units 1 & 2 and makes access safer and easier and enables more efficient retrieval of birds. Use of hunting dogs will be encouraged to reduce the crippling loss of birds, however, as with all dogs on

the refuge, retrievers must be under the control of their handlers at all times. Failure to control a dogs activities can result in citation of the owner.

All firearms are to remain unloaded until hunters are within the designated hunt area. Each hunter shall possess no more than 25 shells while in the field and only approved non-toxic shot may be used or possessed while afield.

Prospective hunters will apply through a statewide DFG reservation system for a particular hunt day on the refuge or if they are not drawn for a reservation they may enter a daily lottery drawing held each morning at the hunter check station. Neither a reservation nor a lottery drawing guarantees a hunter a specific hunting location on the refuge, it simply establishes the order in which a hunter enters through the check station. Each unit within the hunting area is filled to maximum quota level on a first-come first-served basis. Once hunter quotas are reached no other hunters are allowed to enter that unit until space is made available by hunters leaving the area. Daily permits are issued to hunters as they pass through the check station and each permit is marked with the assigned hunting area to assist in enforcement of unit quotas.

Hunting use has been heaviest on Saturdays, as opposed to Wednesdays, and this trend is expected to continue. During the waterfowl hunt season of fall/winter 2003/2004, an average of 2.74 birds per hunter were harvested from the Refuge. Season length and hunter bag limits change each year as regulations are modified to account for habitat and waterfowl population fluctuations throughout North America. On average, with the refuge hunting only two days a week there are approximately 26 shoot days per year with nearly 3,000 hunters participating.

Both the California Department of Fish & Game (CDFG) and the Service understand the importance to waterfowl of having areas closed to hunting in the southern San Joaquin Valley. For this reason CDFG and the Service have agreed that the first 1,000 acres of wetlands flooded on the refuge will be closed and any additional flooded habitat beyond this amount will be classified as 55% closed and 45% open to hunting. Therefore, if water availability results in 1,000 or less acres of flooded wetland habitat, no hunting will occur. Since the refuge was established under the authority of the Migratory Bird Conservation Act (MBCA), the Service is authorized to permit hunting on no more than 40% of the total area of the refuge. Based on the existing agreement with CDFG the refuge would open no more than 45% of the flooded wetland acreage which would not exceed 2,925 acres which is less than the allowable 4,247 acres authorized by the MBCA.

On the two days a week when hunting is permitted on the refuge, a check station is staffed by CDFG personnel that monitor all vehicle and pedestrian traffic entering and leaving the refuge. All hunters are checked in as they enter and are again checked as they exit the hunt area. In addition to the obvious safety aspects of ensuring that all hunters are accounted for at the end of the day, hunter success data is collected and hunter bags are checked for compliance with existing hunting regulations. To ensure that non-hunters do not accidentally enter the hunt area, check station personnel contact all visitors and redirect non-consumptive users away from the hunt area. Alternative wildlife observation opportunities are suggested to these visitors. Never are hunters and non-hunters allowed in the same areas of the refuge. This is done primarily to limit the possible philosophical conflicts over the issue of hunting but also is for safety reasons as well.

The hunting program at Kern conforms to the regulations established by the State of California pursuant to the regulatory framework provided by the Service. This framework is developed each year by the Flyway Councils, States and the Service through an process known as Adaptive Harvest Management which considers, among other factors, resource population levels, habitat conditions, and anticipated harvest levels (Williams and Johnson 1995). In addition to conforming to state and federal regulations, the refuge establishes Special Regulations that are published in the Code of Federal Regulations that further restrict hunter activities and hunting methods. Such restrictions as limiting hunters to 25 shot shells in their possession in the field helps reduce birds being shot at beyond acceptable ranges and reduces crippling losses. Other Special Regulations limit hunter movements within the spaced blind area, eliminate the use of motors on boats, require the use of non-toxic shot while hunting pheasants and restrict when firearms may be carried while loaded. Some of these restrictions contribute toward achieving a safe and enjoyable hunting experience, while others contribute toward a healthy refuge environment.

Availability of Resources: To facilitate this use, the Refuge provides adequate staff which includes administrative, managerial, biological, and when available, a Refuge law enforcement officer to perform hunter compliance enforcement. Due to changes in Service policy regarding refuge law enforcement personnel, there may be times when a trained Service law enforcement officer (LEO) will not be available on the refuge in a full time capacity. When this is the case, LEO's from other refuges will be detailed to the refuge to provide the necessary refuge patrol activities. The California Department of Fish and Game provides one full-time and one or two seasonal employees to administer the hunter check station and daily processing of hunters and monitoring of game taken. Additional law enforcement is provided by California Department of Fish and Game wardens and on occasion, Fish and Wildlife Service special agents.

The public hunting program on Kern NWR and eight other NWR's in California are administered cooperatively with the California Department of Fish & Game under the provisions of a Cooperative Agreement last amended in 2001. This agreement details the responsibilities and costs associated with the implementation of the hunt program on each refuge and provides a detailed list of costs to be reimbursed to the Service by the State. Some of the cost items listed for reimbursement include: signs, brochures, permit compliance, access control, maintenance of the check station, blinds, and parking lots, and administrative functions such as managerial, biological and clerical support. Each year the State is invoiced for these costs by the Service including an inflation factor. For the 2003-04 hunting season, the reimbursement to the refuge for costs directly associated with the hunt program will be $11,440. Essentially, the refuge incurs no un-reimbursed expenses specifically for administering and monitoring the hunting program.

In addition to staffing the hunter check station and performing refuge clean-up duties, the CDFG staff also performs all refuge sign posting tasks as directed by the Refuge Manager to conform with current habitat conditions.

Anticipated Impacts of the Use: Annual fluctuations in the amount of refuge area open to hunting and consequently the numbers of hunters allowed on the refuge are a direct result of the quantity of fall water the refuge receives and the resulting wetlands provided. Fluctuations in waterfowl population trends are monitored annually on a continent wide basis by the Service through breeding ground and waterfowl production surveys and migration surveys such as the

mid-winter inventory that is conducted on a flyway wide basis. As stated earlier, this data is analyzed by the Service and other agencies to develop season lengths and bag limits.

Threatened and Endangered Species: There are currently 4 species found on Refuge that are listed as endangered and one species proposed for listing as endangered. The species are San Joaquin kit fox (*Vulpes macrotis mutica*), Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*), blunt-nosed leopard lizard (*Gambelia silus*), and Buena Vista Lake ornate shrew (*Sorex ornatus relictus*) respectively. Use of the hunter access route as well as the wetland areas of the refuge are very uncommon for the three upland dwelling species; blunt-nosed leopard lizard, Titpton kangaroo rat and San Joaquin kit fox, and according to refuge files no confirmed sightings of any of these three species has occurred in the hunt area in the past 20 years. Both the San Joaquin kit fox and Tipton kangaroo rat are nocturnal and are generally not active during times when hunters are using the wetland areas. Since most hunters enter the refuge before sunrise and some wait to exit after sunset there is a very remote possibility of these animals being on the public use roads during hours of darkness. However, no documented vehicle strikes with these species have occurred. The refuge has a posted 20 mile per hour speed limit and this limit is enforced to protect all refuge wildlife and to support a safe environment for visitors. Speeding tickets have been issued and warnings are given as needed. The blunt-nosed leopard lizard is not found within the wetlands and is hibernating during the cooler months of hunting season so conflicts with hunters is not an issue.

The Buena Vista Lake ornate shrew has been confirmed to occur within the spaced blind portion of the hunting area. However, the habitat occupied by the shrew is along riparian areas where vehicle traffic is prohibited. Its habitat is also off limits to pheasant hunters and no waterfowl hunting blinds are located within 1/4 mile of this habitat. Therefore, the potential for impacts by hunters on this species should not be considered significant. Pheasant hunting is only permitted within the free roam areas of wetland units so impacts from pheasant hunters to any listed species should be no greater than that of waterfowl hunters. Due to the limited nature of the upland pheasant cover where an extensive hunt could impact pheasant population levels and where possible conflicts with listed species in those areas could occur, a large scale pheasant hunt involving upland habitat has never been considered and is not being proposed at this time.

Due to the spacial separation of hunting activity and species habitat limitations, season of use, and restrictions on hunter activity, the possibility of conflicts or impacts by hunters on listed species is very remote. A Section 7 consultation and resulting Biological Opinion were completed for full implementation of the Kern NWR Mater Plan (USFWS) that resulted in a finding of not likely to jeopardize the continued existence of listed species on the refuge. A revised Section 7 will be prepared for the refuge CCP that will address the alternatives presented in the EA including the potential changes to the hunting program.

Migratory Birds: The hunting program is limited to waterfowl, coots, moorhens and ring-necked pheasants only within the wetland areas of the refuge. Therefore human activity may disturb or harm both target and non-target migratory birds only in riparian, and wetland habitats on the Refuge. Hunters may accidentally take non-target migratory birds due to misidentification, however, this is rare and is usually reported to refuge or CDFG staff by other hunters. A certain level of self enforcement is prevalent with the refuge hunters. Select numbers of waterfowl belonging to target species would be taken by hunters each season, but this is not expected to

result in significant adverse effects on their populations. As stated previously, hunting regulation frameworks which include hunting limits are established annually through the adaptive harvest management process which includes factors such as anticipated hunter harvest of waterfowl. These guidelines are proposed for the Pacific Flyway and the State establishes hunting limits which fall within these framework guidelines.

Other Biological Resources: Litter discarded by visitors can entangle wildlife or possibly be ingested, resulting in death or injury. Litter control is a major emphasis item in the routine maintenance of the refuge public use areas. Trash cans and restrooms are provided year round in parking areas for use by the public while involved in wildlife observation, photography, education, interpretation as well as hunting. Additional restrooms and trash cans are provided and maintained by the State during the hunting season. Each year the State employees assigned to the hunt program conduct daily litter patrols following each hunt day, clean the blind areas and levees at least monthly to collect spent shell casings and litter and conduct a major refuge clean-up at the end of the season. During the hunt season the trash cans are emptied daily by CDFG staff and the hunters are encouraged by the State employees to keep the area clean and to use the trash cans provided.

Additional potential impacts to resident and migratory wildlife include the trespass of hunters outside the established hunt zone and dogs harassing wildlife. The hunt area is patrolled on shoot days and refuge employees performing routine work also actively watch for hunters outside of their assigned areas. While hunter trespass may cause a temporary disturbance to wildlife in the immediate vicinity of the activity, this violation is rare and wildlife temporarily displaced have large areas closed to hunting in which to seek refuge. Dogs have not generally been observed harassing wildlife and are normally kept under close control by the hunters themselves.

As the current hunt program is operated, the main tour route is closed on hunt days since it runs through the area that is hunted. Wildlife viewing opportunities on the two shoot days each week are limited due to this closure. Proposed in the Draft CCP is the creation of a new tour route located in a portion of what is now closed area. If this change is included in the finalized CCP then possible temporary displacement of waterfowl and other birds from a small portion of the closed area in close association to the new tour route is possible. Waterfowl displaced from limited areas within the closed area of Kern seldom move far and very rarely venture into the hunt area where they are impacted by hunters (Hardt, pers, comm).

Public Review and Comment: During completion of the Master Planning process in 1984 the hunt program underwent public review. A notice of Proposed Action was issued as well as five informational news letters and four news releases. Public open houses have been held at various times to accept comments on the hunt program as well as direct communications with hunters and bird watchers throughout the years. As part of the CCP process, a public review and comment period will be included during which time the current hunting program and proposed minor changes will undergo public scrutiny.

Determination (Check one Below)

_____ Use is not compatible

___X___ **Use is compatible with stipulations**

Stipulations Necessary to Ensure Compatibility:

I. The refuge will continue to follow the conditions of the agreement by establishing 1,000 acres of sanctuary before wetland habitat is open for public hunting. If 1,000 acres or less of wetland habitat are available due to water restrictions, then no hunting will be allowed for that particular waterfowl hunting season.

II. Regulatory directional signs, as well as maps, will clearly mark hunting areas (free roam and blind site units), closed areas, and available parking lots. Additional pamphlets at the refuge headquarters will provide further information including special season restrictions, California, and refuge regulations. Signs will be maintained and replaced on an as needed basis.

III. Law enforcement patrols will be conducted on a routine basis in cooperation with California Department of Fish and Game wardens to ensure regulation compliance and the protection of Refuge resources. All laws applicable to the refuge hunting program included in the Code of Federal Regulations and the State of California Fish and Game Code will be enforced. The Refuge will increase law enforcement patrols when staff is available, particularly during opening weeks of waterfowl hunting season, to document hunter use and ensure compliance with Refuge and California regulations.

IV. By 2005, a new interpretive kiosk will be installed near the Refuge demonstration pond to inform hunters of refuge habitats as well as wildlife resources and ways to avoid adverse impacts to the resources. Other information will include general hunting and special regulations.

V. To deter hunters from taking long shots thereby reducing disturbance, decreasing the possibility of target misidentification, and decreasing the crippling loss of target species, waterfowl hunters will be limited to no more than 25 shells while in the field and will be required to use only approved non-toxic shot. Current levels of shell compliance checks will be maintained to keep compliance at current or better rates.

VI. Annual monitoring of waterfowl hunter use and impacts will continue to be implemented. The information gathered will be used to review and possibly revise hunting regulations to enhance the quality and safety of the Refuge's hunting program, and ensure hunting would continue to be compatible with the Refuge purpose and the mission of the National Wildlife Refuge System.

VII. Upon final approval of the Kern NWR Comprehensive Conservation Plan, a step down Public Use Plan will be developed that will provide management guidelines for operation of the refuge hunting program.

Justification: The mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the Unites States for the benefit of present and future generations of Americans. Additionally, the National Wildlife Refuge System Improvement Act of 1997 recognized the importance of connecting people with the land and its resources. Wildlife-dependent recreational activities such as hunting, fishing, wildlife

observation, wildlife photography, environmental education, and interpretation are all important opportunities for making this connection possible.

As early as the 1930's, sportsmen in Kern County became alarmed with the loss of wetlands in the area and began petitioning for the establishment of a refuge in the area. One of the five justifications for establishment of the refuge in 1960 was that the area would provide opportunities for public hunting. The purpose for establishing the refuge was "for use as an inviolate sanctuary or for any other management purpose, for migratory birds." Hunting is recognized as a management activity for migratory birds and therefore, hunting is consistent with the purpose for which the refuge was established.

Hunting is a high priority public use that has occurred on the refuge for over 40 years. The hunting program has been developed and modified over the years to minimize the impact to other users such as bird-watchers and photographers, provide adequate closed areas for waterfowl and other wetland dependent species, restrict hunter access and hunter densities in the hunt areas, protect T&E species from hunter impacts, and ensure that hunters conform to applicable state and federal hunting regulations. These actions have developed a safe program for participants while simultaneously protecting the natural resources on the refuge.

Regulations such as the limit on the number of shells a hunter may possess, the type of shot that may be used and the prohibition of boat motors all contribute to sustaining a healthy environment. Law enforcement patrols and enforcement of regulations limit impacts to non-target species and encourage the ethical and fair take of migratory game birds and pheasants in numbers appropriate for the population levels occurring during a specific season.

Mandatory Re-Evaluation Date (provide month and year):

__2018__ Mandatory 15-year Re-Evaluation Date (for priority public uses)

_____ Mandatory 10-year Re-Evaluation Date (for all uses other priority public uses)

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

__X__ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

_____ Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

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Williams, B.K. and F.A. Johnson, 1995. Adaptive Management and the Regulation of Waterfowl Harvests. The Wildlife Society Bulletin, Vol. 23(3):430-436.

Hardt, David, 2004. Personal communication.

USFWS. 1985. Kern National Wildlife Refuge Master Plan, March 1985

USFWS, 2004. Kern National Wildlife Refuge Draft Comprehensive Conservation Plan, May 2004

Refuge Determination:

Prepared by: _____ _____
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: _____ _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____ _____
(Signature) (Date)

Regional Chief,
National Wildlife
Refuge System: _____ _____
(Signature) (Date)

California/Nevada
Operations Manager _____ _____
(Signature) (Date)

Compatibility Determination

Use: Wildlife observation and photography

Refuge Name: Kern National Wildlife Refuge

Establishing and Acquisition Authority:

The Kern National Wildlife Refuge, located in Kern County, California, was established November 18, 1960, under the provisions of the Migratory Bird Conservation Act (16 U.S.C.§ 715d).

Refuge Purpose(s):

Migratory Bird Conservation Act "for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." (16 U.S.C.§71sd)

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

Description of Use(s):

The Kern National Wildlife Refuge (refuge) is open to the public daily from sunrise to sunset to engage in wildlife observation and photography along an established 6.5 mile auto tour route; on foot, utilizing established roads and levees found adjacent to the auto tour routes, and from non-motorized boats such as kayak, canoe, and pith boat. The National Wildlife Refuge System Improvement Act of 1997 identifies wildlife observation, photography, and interpretation as wildlife dependent public uses for National Wildlife Refuges, as well as hunting, fishing, and environmental education.

Areas closed to the public are signed as such and primarily include areas designed as sanctuary for waterfowl or habitat for threatened and endangered species. There are no established "trails" for this use. Approximately 15 miles of levee roads, excluding the 6.5 mile auto tour route are available for these uses and 1,870 acres of flooded acres are available for these uses via non-motorized boat. Visitors engaged in this use are welcome to walk, not drive, the established roads and levees adjacent to the auto tour route and operate non-motorized boat in units 1, 1A, 2, and 2A (see map 1). An average of 800 people per year participate in this type of use..

Wildlife Observation: Wildlife observation is primarily conducted via auto along the self-guided, 6.5 mile auto tour route, foot access on established levees and roads adjacent to the auto tour route, and by non-motorized boat. Throughout the waterfowl hunt season, the tour route and units open to boating, are closed to all non-consumptive recreation, and only on Wednesdays and Saturdays. Wildlife observation occurs in all habitat types on the refuge including riparian, alkali scrub, marsh/seasonal wetland, alkali playa, cultivated cropland, and valley grassland all of which are accessible along the auto tour route and adjacent established levee roads.

Wildlife Photography: Wildlife photography would occur on the refuge and along the self-guided auto tour route, established roads and levees, and via non-motorized boat in units 1, 1A, 2, and 2A. Photographers, searching for a more unstudied photo opportunity than wildlife found along the auto tour route, would be allowed to seek out these opportunities along auxiliary levees and areas by boat. Commercial photography, or other forms of image capturing, requires a Special Use Permit issued by the refuge. Economic uses of natural resources are authorized on national wildlife refuges where the use is determined to contribute to the accomplishment of the specific refuge where the use is to take place (16 U.S.C. 515s). Economic uses on national wildlife refuges can include timber removal, the grazing of livestock, mineral extraction, or uses which facilitate approved programs on national wildlife refuges. Commercial photography would be applicable to wildlife observation and wildlife photography uses, facilitating the refuges' public use program. There are currently two photography blinds planned as part of the Comprehensive Conservation Planning process. Existing disabled waterfowl hunter blinds are available for photographing wildlife after the waterfowl hunting season beginning in early February through early October each year and excluding Saturday and Wednesday during waterfowl hunting season.

Interpretation: A pamphlet is available at the kiosk or at the Refuge Headquarters which provides information for 10 interpretive stops along the auto tour route, as well as other general Refuge information. Interpretive panels have been placed along the tour route which provide additional information of wildlife and their respective habitats observed along this route. There are no interpretive panels along the auxiliary levees adjacent to the auto tour route.

Availability of Resources: Adequate funding and staff exist to meet the maintenance and management needs of the auto tour route for wildlife observation and wildlife photography. Activities include but are not limited to road and interpretive panel upkeep as well as updating pamphlets and replacing closed area signs. Estimated personnel and supply costs for grading roads (3 times per year), mowing road shoulders (4 times per year), cleaning litter from road shoulders, and adding road material where necessary annually totals $4,500. Additionally, $500 is expended to cover personnel costs and supplies for printing, updating, and stocking pamphlets. Administrative costs associated with issuing special use permits is estimated at less than $200 annually. Further information regarding resources related to this use can be viewed in the Compatibility Determination for Environmental Education and Interpretation.

For information on road maintenance and additional coast analysis regarding these uses, please refer to the 1984 Refuge Master Plan for Kern National Wildlife Refuge as well as the Environmental Assessment for the 2004 Draft CCP.

Anticipated Impacts of the Use:

Threatened and Endangered Species: Human activity has had adverse impacts on threatened and endangered species found in the Southern San Joaquin Valley (Germano and Williams, 1993, Williams 1995, and Orloff et al. 1986). There are currently 4 species found on the refuge that are listed as endangered; San Joaquin kit fox (*Vulpes macrotis mutica*), Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*), blunt-nosed leopard lizard (*Gambelia silus*), and Buena Vista Lake ornate shrew (*Sorex ornatus relictus*). Impacts to these species is considered non-adverse as San Joaquin kit fox and Tipton kangaroo rats are generally not active during the time

when the general public in on the refuge. San Joaquin kit fox and Tipton kangaroo rats have been observed in areas on the Refuge which consist of upland habitats, most of which is closed to public access. Blunt-nosed leopard lizards are diurnal, and therefore have a higher risk for adverse impacts, in particular, through auto strikes. The speed limit on the auto tour route is regulated to 20 mph, providing ample time to slow and stop for wildlife. Refuge staff on occasion remind visitors of the posted speed limit as no law enforcement officers are currently employed at the Refuge. Immediate habitat where Buena Vista Lake ornate shrew has been found is open to foot traffic only. Due to the sensitivity of the habitat area, and safety concerns posed by venomous snakes, the public is discouraged from entering the area. Other impacts from auto traffic could involve temporary disruption of an animal from it's living quarters, feeding, or breeding sites.

According to Refuge biological files, there are no known auto strikes of threatened or endangered species along the auto tour route.

For additional information on impacts to threatened and endangered species regarding this use, please refer to the 1984 Refuge Master Plan for Kern National Wildlife Refuge as well as the Environmental Assessment for the 2004 Draft CCP.

Migratory Birds: Human activity involved with this use may disturb migratory birds utilizing the refuge's habitats primarily during feeding and breeding activities (Korschgen and Dahlgren 1992). Several species of ground nesting birds to the refuge include killdeer (*Charadrius vociferus*), black-necked stilt (*Himantopus mexicanus*), American avocet (*Recurvirostra americana*), and various waterfowl. White-faced ibis (*Plegadis chihi*) and tri-colored blackbirds (*Agelaius tricolor*) breed on the refuge within units accessible to this use via non-motorized boat. The previously mentioned species can be migratory, leaving wintering areas for breeding areas, or resident, living in the same area year-round. Short-term impacts to these species occur when they are temporarily displaced from marsh/seasonal wetland edge nests and roadside habitat as vehicles or people pass by or stop on the tour route or as people walk and stop along established roads and levees.

These disturbances are not vastly different than those as a result of normal refuge operation that include large farm equipment and biological surveys. Long-term positive impacts involve primarily the public's appreciation of natural resources and the National Wildlife Refuge System. This displacement typically occurs during the breeding season, late March through early August, when avian species rearing young is at its peak, and for lengths of time ranging from 3-10 minutes (Kern NWRC biological files). Monitoring and adjustable management of these uses would be implemented to ensure that impacts remain within acceptable levels. Participation of these uses via non-motorized boat would be allowed between 1 September and 1 March to avoid impacts and disturbance to breeding and rearing of young.

Disturbances by the public would be more frequent especially during the early breeding season, March-April, as the weather is of a mild nature. Public use of this type lessens considerably as the temperatures increase, May-August. Long-term positive impacts involve the public's long lasting education and appreciation of natural resources in the Southern San Joaquin Valley, the importance of the Refuge in the Pacific Flyway, and the National Wildlife Refuge System.

Possible long term adverse impacts due to disturbance of nesting migratory birds could involve nest failure, increased chick depredation, nest abandonment (Sowls 1955), and unknown long-term

population declines. Human disturbance to waterfowl has been found to be of greatest impact by uses involving motorized boats, fishing, and hunting (Korschgen and Dahlgren 1992). These impacts are avoided on the refuge as fishing is not allowed, hunting occurs during the winter months when birds are not breeding, and only non-motorized boats are allowed between 1 September and 1 March during the non-breeding season.

Continued compatible practice of this use on the Refuge is supported by the purpose for which the Refuge was created. Kern NWR was established and is managed for wintering waterfowl populations in the Southern San Joaquin Valley. The overall numbers of waterfowl present during April-July is demonstrably lower, as much as 75%, than the wintering population. These numbers are generated from the annual Statewide Mid-winter Waterfowl count (USFWS 1980-2004) and on-the-ground surveys conducted by Refuge staff.

Refuge Habitats: Impacts to Refuge habitats including riparian, alkali scrub, marsh/seasonal wetland, alkali playa, cultivated cropland, and valley grassland could be of concern if visitors do not regulate themselves to the roads and levees. Impacts could involve the trampling of vegetation and displacement of wildlife beyond the auto tour route. Closed area signs along wildlife viewing routes, auto tour route and levee roads, are currently posted to ward adverse impacts to refuge habitats. Visitors are allowed to walk or drive along these designated routes provided the area is not posted as closed.

Other Biological Resources: Litter discarded by visitors can entangle wildlife or possibly be ingested, resulting in death or injury. This has not posed a serious problem in the past and is not expected to increase as visitation increases. Additionally, adequate facilities for garbage disposal exists to all Refuge visitors. Garbage sites are found within the boundaries of three public parking areas as well as Refuge headquarters. Restrooms are available for visitor use at Refuge headquarters and at the public parking areas along the auto tour route.

Public Review and Comment: During completion of the Master Planning process of 1984, this use underwent public review. A notice of Proposed Action was issued as well as informational news letters and four news releases. As part of the Comprehensive Conservation Planning process, a public review and comment period will be included during which time this use and proposed minor changes will undergo public scrutiny.

Determination: (Check One Below)

_____ Use is not compatible **___X___ Use is compatible**

Stipulations Necessary to Ensure Compatibility:

Regulatory and directional signs will clearly mark the tour route and areas along this route which are closed to the public as well as areas open to non-motorized boats.

Uses will not be allowed during shoot days, Wednesdays and Saturdays, October through January.

Participation in these activities via non-motorized boat would be allowed between 1 September and 1 March.

Maps and public use information are to be made available at the kiosk at the entrance to the Refuge as well as at the Refuge Headquarters.

Participation of these activities via non-motorized boat by groups of 3 or greater will require a Special Use Permit.

Seasonal closures of specific auxiliary dikes will be posted if necessary. Closures would be in place due to rain and muddy road conditions or general refuge maintenance in order to keep the public safe and to prevent damage to roads that require expensive repair.

Access to the Refuge will be allowed only between sunrise and sunset unless a special use permit is obtained from the Refuge Manager to engage in this use during alternative hours.

By 2005, a new interpretive kiosk will be installed near the refuge demonstration pond to inform visitors of its habitats as well as wildlife resources and ways to avoid adverse impacts to the resources which would include remaining on existing roads, keeping a respective distance from nesting birds, and alternative wildlife viewing opportunities during the waterfowl hunt season. This kiosk will replace a smaller kiosk currently in use which provides this same information.

The refuge currently has no law enforcement officers on staff to monitor this use. Refuge staff will periodically monitor activities of visitors participating in these activities to ensure compliance. In the event this use is not being adhered to as and impacts associated with this use are observed, adaptive management measures will be taken. Some adaptive management measures taken will involve, but not be exclusive to, fencing the public from sensitive areas, reviewing signed areas and making appropriate changes, or closing specific areas to public access.

Justification: Wildlife observation and photography are public uses that will allow the visitors to enjoy, experience native wildlife, plants, and habitats. Since the majority of the land near and adjacent to the refuge has been highly modified and converted to agriculture, and is held in private ownership, the refuge plays an important role in allowing the public to view and experience animals in a local, natural setting. Regulatory and directional signs, as well as maps and pamphlets, provide the necessary information for the public to enjoy the refuge wildlife, reduce long-term adverse impacts to wildlife and habitats on the refuge as well as opportunities to view native wildlife and plants.

As expressed priority uses of the Refuge system, these uses take precedence over other potential public uses in Refuge planning and management. The Service strives to provide priority public uses when compatible with the purpose of the Refuge and the mission of the National Wildlife Refuge System.

These uses, when conducted in accordance with the stipulations, would not be expected to result in adverse impacts to refuge resources, and may benefit these resources by helping increase public awareness of refuge resource. Proposed wildlife observation and photography via non-motorized boat conducted in accordance with the stipulations herein would be compatible with the refuge purpose and the National Wildlife Refuge System mission.

Mandatory Re-evaluation Date (provide month and year):

2019 Mandatory 15 year Re-evaluation Date (for priority uses)

_____ Mandatory 10 year Re-evaluation (for all uses other than priority public uses)

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

_____ Categorical Exclusion without Environmental Action Statement

____ Categorical Exclusion and Environmental Action Statement

__X__ Environmental Assessment and Finding of No Significant Impact
The 1985 Environmental Assessment addressed effects associated with the implementation of the Master Plan (1984) for the Kern NWR. *

_____ Environmental Impact Statement and Record of Decision

* The refuge will work under the guidance of the signed Kern NWR Master Plan until the current planning process for the Kern and Pixley National Wildlife Refuge Complex Comprehensive Conservation Plan is complete and witnessed.

References Cited:

1955. Sowles, L.K.. "Prairie Ducks." Wildlife Management Institute, Washington, D.C.

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1985. D. F. Williams. A Review of the Population Status of the Tipton Kangaroo Rat, Dipodomys nitratoides nitratoides. U. S. Fish and Wildlife Service, Sacramento, Non-game Wildl. Invest., Final Rep. E-W-R, IV-10.0 48 pp.

1986. S. G. Orloff, F. Hall, and L. Spiegel. Distribution and Habitat Requirements of the San Joaquin Kit Fox in the Northern Extreme of Their Range. Trans. West. Sect. Wildl. Soc. 22:60-70.

1992. Korschgen, C. E. and R.B. Dahlgren. Human Disturbances of Waterfowl: Causes, Effects, and Management. USFWS, Fish and Wildlife Leaflet 13.2.15, pp 1-8.

1993. D. J. Germano and D. F. Williams. Recovery of the Blunt-nosed Leopard Lizard: Past Efforts, Present Knowledge, and future Opportunities. Trans. West. Sec. Wildl. Soc. 28:38-47.

USFWS, Kern NWRC, biological files. Kern NWRC, Delano, California.

USFWS. Mid-winter Waterfowl Survey. Results from 1980-2004.

Refuge Determination

Prepared by: _____ _____
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: _____ _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____ _____
(Signature) (Date)

Regional Chief,
National Wildlife
Refuge System: _____ _____
(Signature) (Date)

California/Nevada
Operations Manager _____ _____
(Signature) (Date)

Compatibility Determination

Use: Environmental Education and Interpretation

Refuge Name: Kern National Wildlife Refuge

Establishing and Acquisition Authority:

The Kern National Wildlife Refuge, located in Kern County, California, was established November 18, 1960, under the provisions of the Migratory Bird Conservation Act (16 U.S.C.§ 715d).

Refuge Purpose(s):

Migratory Bird Conservation Act "for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." (16 U.S.C.§71sd)

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

Description of Use(s):

The Kern National Wildlife Refuge (refuge) proposes to enhance existing environmental education by strengthening existing partnerships with area schools, universities, conservation groups and other organizations such as California Regional Environmental Education Community (CREEC). Environmental education and interpretation have been identified as priority public uses for National Wildlife Refuges by the National Wildlife Refuge System Improvement Act of 1997.

The refuge has developed an educators guide and plans to develop more environmental education and interpretive materials that will include a new general refuge brochure, as well as various endangered species and native habitats fact sheets. To further accomplish this purpose, the refuge will also utilize existing National Wildlife Refuge System environmental education items such as those concerning wetlands and the ecology of migratory birds. These materials would serve to interpret the value of local wildlife and their respective habitats and the importance of the refuge and the National Wildlife Refuge System in conserving their biological integrity.

The refuge supports populations of endangered species such as Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*), blunt-nosed leopard lizard (*Gambelia silus*), Buena Vista Lake ornate shrew (*Sorex ornatus relictus*), and San Joaquin kit fox (*Vulpes macrotis mutica*). Other species found on the refuge that are of concern to the State of California and the federal government are tri-colored blackbirds (*Agelaius tricolor*) and burrowing owl (*Athene cunicularia*). The Refuge is an important place on the Pacific Flyway providing habitat for thousands of wintering waterfowl species such as canvasback *(Aythya valisineria*), mallard (*Anas platyrhynchos*), and green-

winged teal (*Anas crecca*) as well as various species of shorebirds during winter and spring months.

The refuge is currently open to the public everyday from sunrise to sunset to engage in environmental education and interpretation along an established 6.5 mile auto tour route and on foot, utilizing established roads and levees. There are no established "trails" for this use. Approximately 15 miles of levee roads, excluding the 6.5 mile auto tour route, are available for this use via foot. Visitors engaged in this use are welcome to walk, not drive, the established roads and levees adjacent to the auto tour route. Additionally, these activities would also occur near the refuge demonstration pond near the main headquarters building at the site of the proposed refuge kiosk to be completed in 2005.

The refuge currently has no interpretive or educational displays at its headquarters facilities and environmental education materials are somewhat sparse. Several educational and conservation organizations utilize the refuge for educational purposes, typically during the winter and spring months. Some of these organizations include Kern Audubon Society, Tulare Audubon Society, Tehachapi Mountain Birding Club, local museum groups, area historical societies, as well as groups from California State University Bakersfield. Estimates for this use which involves conservation groups conducting environmental education and interpretation on the refuge averages 800 persons a year.

The refuge currently engages in environmental education and interpretation to illustrate the importance of native habitats for threatened and endangered species as well as those habitats for migratory birds, particularly waterfowl and resident wildlife. Tours are scheduled on a call-in basis and duties are shared among refuge staff. Tours are varied depending upon the groups request. Requests can focus on migratory bird resources, water use, habitat management, or a combination of the three. School groups which request a refuge educators guide are encouraged to request an additional environmental education game/activity as a part of the tour request.

A pamphlet is currently available at the existing kiosk or at the refuge headquarters that provides information for 10 interpretive stops along the self-guided auto tour route, as well as other general refuge information. Interpretive panels have been placed along the tour route and provide information on wildlife and their respective habitats.

By 2005, a new kiosk located near the refuge demonstration pond, will be built and will provide the following information:

1. An orientation map showing the location of the auto tour route, levees and roads available for foot and auto traffic, and other specific regulations.
2. A display panel which illustrates the National Wildlife Refuge System.
3. Interchangeable sign detailing the hunting season and applicable changes.
4. Spaces for various pamphlets including new general refuge brochure, species list, and wildlife fact sheets.
5. A history of the Southern San Joaquin Valley and its related wildlife resources illustrating wetland resources from pre-European arrival to the present.

This new kiosk and interpretive signs would be larger than the existing kiosk and will additionally provide visitors with information on the various refuge habitats including marsh/seasonal wetland,

alkali playa, valley grassland, cultivated cropland, alkali scrub, and riparian. More information would include species found on the Refuge with emphasis on migratory waterfowl and their related habitats; threatened and endangered species; and ways visitors can minimize impacts to wildlife resources and their related habitats.

While most environmental education and interpretation would enlighten the visiting public concerning migratory waterfowl and localized endangered species, other educational aspects would acquaint the public to the National Wildlife Refuge System and the mission of the U.S. Fish and Wildlife Service.

Availability of Resources: Presently, adequate funding and staff meet the current needs for an environmental education and interpretive program at existing visitation rates, but as demand increases, new funding sources will need to be identified. Area schools are requesting hands-on nature activities to emphasize particular curricula topics concerning the environment and to provide students with a well rounded Refuge experience. Approximately $90,000 would be needed for the proposed environmental education and interpretation materials, and building a kiosk with an outdoor education orientation area. In anticipation of increased use in this area, an outdoor recreation planner would be needed at an initial start up sum of $128,000. The Refuge is currently pursuing and will continue to pursue various areas of funding for this use including grant opportunities, partnerships with non-governmental groups, resource sharing with other agencies, and volunteer recruiting.

For information on road maintenance and additional cost analysis associated with these uses, please refer to the 1984 Refuge Master Plan for Kern National Wildlife Refuge as well as the Environmental Assessment for the 2004 Draft CCP.

Anticipated Impacts of the Use(s):

Threatened and Endangered Species: Human activity has had adverse impacts on threatened and endangered species found in the Southern San Joaquin Valley (Germano and Williams, 1993, Williams 1995, and Orloff et al. 1986). There are currently four species found on Refuge that are listed as endangered. The species listed as endangered are San Joaquin kit fox (*Vulpes macrotis mutica*), Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*), blunt-nosed leopard lizard (*Gambelia silus*), and the Buena Vista Lake shrew (*Sorex ornatus relictus*).Impacts to these species is considered non-adverse as San Joaquin kit fox and Tipton kangaroo rats are generally not active during the time when the general public in on the refuge. There are no known denning sites on the Refuge of San Joaquin kit fox, the most recent sightings of this species being south of the Refuge on private property. While blunt-nosed leopard lizards are diurnal, and therefore have a higher risk to be struck by autos, the speed limit on the auto tour route is regulated to 20 mph, providing ample time to slow and stop for wildlife. According to Refuge files, there are no known auto strikes of blunt-nosed leopard lizard, Tipton kangaroo rats, or San Joaquin kit fox on the auto tour route. Refuge staff on occasion remind visitors of the posted speed limit as no law enforcement officers are currently employed at the Refuge. Immediate habitat where Buena Vista Lake shrew has been found is closed to the public. This habitat type is found a minimum of 500 feet from the auto tour route. Other impacts from auto traffic could involve temporary disruption of an animal from it's living quarters, feeding, or breeding sites.

According to Refuge biological files, there are no known auto strikes of threatened or endangered species along the auto tour route.

For additional information on impacts to threatened and endangered species regarding this use, please refer to the 1984 Refuge Master Plan for Kern National Wildlife Refuge as well as the Environmental Assessment for the 2004 Draft CCP.

Migratory Birds: Some individuals belonging to species of ground nesting birds are year-round residents of the Refuge. These species include killdeer (*Charadrius vociferus*), black-necked stilt (*Himantopus mexicanus*), American avocet (*Recurvirostra americana*), and various waterfowl species that are present during early fall through early summer. The previously mentioned species can be migratory, leaving wintering areas for breeding areas, or resident, living in the same area year-round. Short-term impacts to these species occur when they are temporarily displaced from marsh/seasonal wetland edge nests and roadside habitat as vehicles or people pass by or stop on the self-guided auto tour route and along established roads and levees. This displacement typically occurs during the breeding season, late March through early August, and for lengths of time ranging from 3-10 minutes (Kern NWRC biological files). Monitoring and adjustable management of this use would be implemented to ensure that impacts remain within acceptable levels.

These disturbances are not vastly different than those resulting from normal Refuge operation that may include large farm equipment, transportation to and from a work site, and conducting biological surveys. Disturbances by the public would be more frequent especially during the early breeding season, March-April, as the weather is of a mild nature. Public use of this type lessens considerably as the temperatures increase, May-August. This use encourages group environmental education and interpretation, minimizing the impacts to migratory birds and other wildlife by gathering a visiting group together, in one area or vehicle. Long-term positive impacts involve the public's long lasting education and appreciation of natural resources in the Southern San Joaquin Valley, the importance of the Refuge in the Pacific Flyway, and the National Wildlife Refuge System.

Possible long term adverse impacts due to disturbance of nesting migratory birds could involve nest failure, increased chick depredation, nest abandonment (Sowls 1955), and unknown long-term population declines. Human disturbance to waterfowl has been found to be of greatest impact by water uses involving motorized boats, fishing, and hunting (Korschgen and Dahlgren 1992). These impacts are avoided on the refuge as fishing is not allowed, hunting occurs during the winter months when birds are not breeding, and only non-motorized boats are allowed between 1 September and 1 March during the non-breeding season.

Continued compatible practice of this use on the Refuge is supported by the purpose for which the refuge was created. The refuge was established and is managed for wintering waterfowl populations in the Southern San Joaquin Valley. The overall numbers of waterfowl present during April-July is demonstrably lower, as much as 75%, than the wintering population. These numbers are generated from the annual Statewide Mid-winter Waterfowl count (USFWS 1980-2004) and on-the-ground surveys conducted by refuge staff.

Refuge Habitats: Impacts to refuge habitats including riparian, alkali scrub, marsh/seasonal wetland, alkali playa, cultivated cropland, and valley grassland could be of concern if visitors do

not confine environmental education activities to established roads and levees, as required. These impacts have not been observed from visitors engaged in this use in the past. Closed area signs along wildlife viewing routes are currently posted to protect against adverse impacts to refuge habitats. Insuring this use results in minimum impacts would be accomplished by Refuge staff who accompany groups while leading interpretive talks. Staff would send the refuge environmental education guide to groups wishing to partake in this use as part of the text includes specific rules and regulations concerning impacts to wildlife.

Other Biological Resources: Litter discarded by visitors can entangle wildlife or possibly be ingested, resulting in death or injury. This has not posed a serious problem in the past and is not expected to as visitation increases. Additionally, adequate facilities for garbage disposal exists to all Refuge visitors. Refuse disposal sites are found within the boundaries of three public parking areas as well as refuge headquarters. Restrooms are available for visitor use at Refuge headquarters and at one of the public parking areas along the auto tour route.

Public Review and Comment: Public comment on this use was solicited during an August 1999 public scoping workshop as associated with the Environmental Assessment for the Kern NWR Complex Comprehensive Conservation Plan. Several comments were obtained for this use during the August 1999 public scoping workshop. The comments were positive in nature and focused on increasing Refuge visibility and outreach. Two other comments received suggested that an alternative auto tour route be developed for used other than consumptive during waterfowl hunt days.

Determination: (Check One Below)

_____ Use is not compatible **___X___ Use is compatible**

Stipulations Necessary to Ensure Compatibility: In order to allow environmental education and interpretation to occur on Refuge, the following provisions will be followed:

Educators and other groups who wish to visit the Refuge to independently instruct a classroom group or have refuge staff conduct environmental education and interpretation during their visit will receive a Kern NWR Educators Guide. The Educators Guide will be obtained by phoning and requesting a copy before scheduling a tour or trip. Other materials will be provided that include endangered species fact sheets, the refuge, and auto tour route informational brochures.

Seasonal information will be given which advises visitors of the special needs of breeding migratory birds to minimize disturbance.

Sign replacement/installation will be prioritized to keep visitors out of sensitive areas.

Group visitation will be encouraged over individual visitation by persons engaged in these uses. Groups will be encouraged to conduct environmental education and interpretation in established areas (i.e. refuge tour route and new and existing kiosk areas) to lessen impacts to wildlife.

As the need increases, the refuge will recruit volunteers or interns to assist with providing environmental education and interpretive tours.

By 2005, a new kiosk near the Refuge demonstration pond will be built to inform visitors and those engaged in environmental education and interpretation of the refuge's habitats and the wildlife that depend on them. This kiosk will also illustrate refuge rules and regulations, as well as a history of the Southern San Joaquin Valley.

Access to the refuge will be allowed only between sunrise and sunset unless a special use permit is obtained from the project leader to engage in this use during alternative hours.

The project leader will have the authority to close certain areas to interpretive programs, or to cancel activities as he or she deems necessary.

Public access will be restricted to auto tour route and established roads and levees which will result in minimal impact to listed breeding and wintering species.

The refuge currently has no law enforcement officers on staff to monitor this use. Refuge staff will periodically monitor activities of visitors participating in thus use to ensure compliance. In the event this use is not being adhered to and impacts associated with this use are observed, adaptive management measures will be taken. Some adaptive management measures taken will involve, but not be exclusive to, fencing the public from sensitive areas, reviewing signed areas and making appropriate changes, or closing specific areas to public access.

Justification: The goals of the National Wildlife Refuge System include providing an understanding and appreciation of fish and wildlife ecology and the human role in the environment, and providing refuge visitors with high-quality, safe, wholesome, and enjoyable recreational experiences oriented toward wildlife, to the extent these activities are compatible with the purpose for which a refuge was established and the mission of the System. In addition, the National Wildlife Refuge System Improvement Act of 1997 identifies environmental education and interpretation as wildlife dependent public uses for National Wildlife Refuges, along with hunting, fishing, wildlife observation and photography. As expressed priority public uses of the National Wildlife Refuge System, these uses take precedence over other potential public uses in refuge planning and management. The Service strives to provide priority public uses when compatible with the purpose of the refuge and the mission of the National Wildlife Refuge System.

These uses, when conducted in accordance with the stipulations, would not be expected to result in adverse impacts to refuge resources, and may benefit these resources by helping increase public awareness of refuge resource. Proposed wildlife dependant public uses environmental education and interpretation conducted in accordance with the stipulations herein would be compatible with the refuge purpose and the System mission.

Mandatory Re-evaluation Date (provide month and year):

2019 Mandatory 15 year Re-evaluation Date (for priority uses)

_____ Mandatory 10 year Re-evaluation (for all uses other than priority public uses)

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

_____ Categorical Exclusion without Environmental Action Statement

____ Categorical Exclusion and Environmental Action Statement

__X__ Environmental Assessment and Finding of No Significant Impact
The 1985 Environmental Assessment addressed effects associated with the implementation of the Master Plan (1984) for the Kern NWR. *

_____ Environmental Impact Statement and Record of Decision

* The refuge will work under the guidance of the signed Kern NWR Master Plan until the current planning process for the Kern and Pixley National Wildlife Refuge Complex Comprehensive Conservation Plan is complete and witnessed.

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Refuge Determination

Prepared by:	_____ (Signature)	_____ (Date)
Refuge Manager/ Project Leader Approval:	_____ (Signature)	_____ (Date)

Concurrence

Refuge Supervisor:	_____ (Signature)	_____ (Date)
Regional Chief, National Wildlife Refuge System:	_____ (Signature)	_____ (Date)
California/Nevada Operations Manager	_____ (Signature)	_____ (Date)

Compatibility Determination

Use: Grazing program to provide suitable habitat for the endangered Tipton kangaroo rat, blunt-nosed leopard lizard, and San Joaquin kit fox. (Alternative C, Kern and Pixley National Wildlife Refuge Complex Comprehensive Conservation Plan Environmental Assessment)

Refuge Name: Kern National Wildlife Refuge

Establishing and Acquisition Authority:

The Kern National Wildlife Refuge, located in Kern County, California, was established November 18, 1960, under the provisions of the Migratory Bird Conservation Act (16 U.S.C. § 715d).

Refuge Purpose(s):

Migratory Bird Conservation Act "for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." (16 U.S.C.S. §71sd)

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

Description of Use: The Kern National Wildlife Refuge (refuge) would administer a grazing program, which occurs on approximately 2,377 acres of upland habitat on the western side of the refuge, in the grassland areas of units 11 and 12 (see attached map). This use has been occurring on the refuge since 1962 (Kern NWRC files). The refuge would continue to administer this use as outlined in this Compatibility Determination. Although grazing is not identified as a wildlife dependent public use by the National Wildlife Refuge System Improvement Act of 1997, grazing would allow the refuge to manage grassland and forb habitats through the creation of short-grass environments. This use would provide short sparse vegetation to provide suitable foraging and denning habitat for endangered San Joaquin kit foxes (*Vulpes macrotis mutica*), blunt-nosed leopard lizards (*Gambelia silus*), and Tipton kangaroo rats (*Dipodomys nitratoides nitratoides*). Habitat is provided in the form of introduced and native grasses as well as associated native plant food resources, introduced grasses making up a higher overall percentage of the short-grass environment.

The optimal time for grazing begins in November and given winter and spring rainfall, may last through late April. Prior to the beginning of the grazing season, an assessment is made to determine the amount of residual dry matter (RDM) available to the cattle. The number of cattle allowed to graze on the refuge, for a specific amount of time, varies with the amount of local rainfall. Because grazing on the Refuge supports endangered species, this RDM level is linked to the needs of the endangered species and not the needs of the cattle. This RDM is determined by

clipping, drying, then weighing the amount of RDM in representative samples of the unit cattle are to graze and varies upon temperature, monthly rainfall, and the density of new grass/forb growth. Provided that the amount of RDM is less than 750 lbs./acre, prior to or anytime during the grazing season, the refuge manager may request that the permit holder reduce the number of cattle grazing in that unit or remove them all together in order to prevent degradation of the resources in the unit.

Only the grazing of cattle is to be considered on the refuge; grazing by sheep, goats, or other creatures such as bison would not be considered. During drought years or years of low rainfall, cattle will not be allowed to graze on the refuge.

The timing of the placing of cattle on the refuge are termed turn in dates (November 1 or slightly later) and are adjusted year to year based upon the date of the first effective germinating rainfall, and the amount of dry forage available in the fall (Stechman 1995). The timing of removing cattle from the refuge is termed turn out dates and is determined solely on the amount of RDM within the unit. If and when 750 lbs per acre or less is achieved cattle will be removed from the unit.

The unit of measure used to summarize the quantity of cattle grazing on the refuge is termed Animal Unit Month (AUM). AUM is defined as the amount of forage needed by an "animal unit" (AU) grazing for one month. An AU is defined as one mature 1,000 pound cow and her sucking calf. An assumption in this definition is that a cow nursing her calf will consume about 26 pounds of dry matter per day. Other types of livestock are assigned AUM equivalents based on size and consumption.

The grazing cooperator is chosen following guidance in U.S. Fish and Wildlife Service Refuge Manual under heading 5 RM 17. At the time of this writing, there are no anticipated changes to grazing on the refuge.

Availability of Resources: Assistant refuge managers, under the direction of the project leader, would manage the grazing program. The permittee, working under a Cooperative Land Management Agreement, would accomplish certain facility management and improvement projects under the direction of the assistant manager. Accomplishments would be in direct support to the refuge grazing program, these projects may include maintenance or improvements of existing facilities or installation of new facilities. Projects may include installing and/or maintaining water control structures; fence installation, repair, or removal; sign repair, removal, or installation; gate installation, road, building, or deep well maintenance as well as vegetation control around facilities. The permittee is responsible for the cost of maintenance and/or installation of edifices associated with their grazing permit. Facilities that are installed primarily for refuge purposes are constructed or maintained at refuge expense. All projects would be agreed upon before the beginning of the grazing season and would directly support the unit being grazed.

Rates charged per AUM are based on a grazing rate survey of comparable grazing pastures that was conducted in 1995. Each year the current rate is established by adjusting the base rate using a formula created by LaCuesta Consulting that incorporates the average California beef cattle price from the previous year (Stechman 2003). This report was completed in March of 2003 and is updated every five years, all grazing fees are adjusted on a year to year basis based on fluctuations in annual beef prices. Receipts received from permittee(s) at the end of the grazing season are submitted to the General Fund.

At the end of each grazing season, the permittee submits information sufficient for refuge managers to calculate total AUM's for that particular grazing period. When AUM's are calculated, a bill is then submitted to the permittee for collection. Final billing would also take into consideration funds and in kind contributions furnished by each permittee as outlined in their individual Cooperative Land Management Agreements. These work contributions would be deducted on the permittee's final bill with proof of receipt or performed labor. Work contributions of this type would be associated with improvement projects for the particular grazed unit.

The refuge receives adequate funding to cover the costs associated with management of the grazing program including the RDM assessment conducted at the end of every grazing season. Staff costs associated with this use emanates from the annual review of Special Use Permits, Cooperative Land Management Agreement, and monitoring the impacts of this use as outlined in the Grazing Plan. Annual costs for this use averages $3,000.00. Management of this use also involves monitoring resource impacts associated with this use on the short-grass environments as well as to endangered species.

For a more in depth review of costs associated with this use, the reader is referred to the cost analysis in the Draft Comprehensive Conservation Plan.

Anticipated Impacts of the Use: To provide this use, the refuge has adequate staff which includes biological, administrative, and managerial. The grazing program results in both long and short term effects, both negative and positive. The Biological Opinion (BO) for Kern National Wildlife Refuge 1984 Master Plan, identified the following short and long-term negative impacts to wildlife resources from grazing: Trampling of desirable vegetation, disturbances to ground nesting species, trampling of rodent burrows, fencing that may restrict the movements of large animals, soil compaction especially during wet periods. The BO recommended the following activities to minimize negative impacts associated with grazing: Acquiring additional land with suitable habitat, allowing the use in years of adequate rainfall only, and supporting grazing within the same unit areas and not moving animals to un-grazed or sensitive areas. Conversely, short and long-term positive impacts include an overall reduction of undesirable, non-native vegetation, as well as the re-establishment of native grass, forb, and shrub communities. The refuge was established on land which was previously used for the grazing of cattle and other ungulates. To provide adequate food for the grazing livestock, non-native grasses were seeded and encouraged. At the time of purchase, it was estimated that 85% of the refuge was covered in non-native grasslands. Impacts of cattle to existing water supplies is negligible. Water is brought in to cattle from a well located off refuge and water is brought, via buried plastic pipe to a large, 1000 gallon water tank then gravity fed to cattle troughs. To minimize negative impacts, the location of plastic pipe would not change.

While studies to determine the effects of grazing on local threatened and endangered species have been conducted on the refuge and surrounding lands in the Southern San Joaquin Valley, and these studies have indicated a benefit from decreased vegetation to these species (Williams 1985 and O'Farrell 1983), the duration and timing needed for optimal benefits is poorly understood. These studies have been conducted annually on lands surrounding the refuge, but strong evidence to support a result which indicate a positive correlation have not been forthcoming. Part of the blame for a lack of strong correlative evidence is placed on an inconsistent annual rainfall, where a consistent average rainfall would support data indicating either positive or negative impacts to local species from grazing.

Another endangered species which resides on the refuge, the Buena Vista Lake ornate shrew (*Sorex ornatus relictus*). The areas in which this species of shrew resides in is riparian habitats. On the refuge, riparian habitat areas are not grazed by cattle and are not located in the upland areas of the refuge where cattle would graze. Periodic surveys would provide presence/absence data for this species throughout the refuge.

Additionally, cattle are grazed in areas which are closed to the public and also are out of direct view of the general public. These areas are fixed and will not occur in areas open to the public or in areas outside of the fixed area.

Impacts to known cultural resources from this use are negligible. Arguelles and Moratto (1982) identified and reviewed known new and previously known sites containing cultural resources on the refuge. Sites containing human remains are out of the area of impact and are similarly closed to public access. An additional study conducted by Fish and Wildlife Service in 2000 in conjunction with the Comprehensive Conservation Planning process.

The 1984 Master Plan identifies the need to develop additional information relating to the effects of grazing on local endangered species. While the effects have been determined to be negligible in negative impacts when the timing and conditions regarding cattle turn in and turn out dates are adhered to, additional research and evaluation would allow the refuge to refine its management strategies and objectives for grassland management.

Public Review and Comment: During completion of the Master Planning process of 1984, the grazing program underwent public review. A notice of Proposed Action was issued as well as informational news letters and four news releases. Public open houses have been held at various times to accept comments on the grazing program. As part of the Comprehensive Conservation Planning process, a public review and comment period will be included during which time the current grazing program and proposed minor changes will undergo public scrutiny.

Determination: (Check One Below)

_____ Use is not compatible **___X___ Use is compatible, with Stipulations**

Stipulations Necessary to Ensure Compatibility: The Cooperator is operating under the terms and conditions of a Cooperative Land Management Agreement, Special Use Permit, and an existing Refuge Grazing Plan. These documents provide the necessary information and assistance from the refuge to determine start and end dates for cattle placement and removal.

Additional Stipulations are as follows:

It is the responsibility of the refuge manager to determine fair market value of grazing, to issue special use permits, monitor permittee compliance, and maintain up-to-date files on all grazing activities.

In order to minimize the amount of new noxious weeds being introduced to the refuge, cattle brought to the refuge to graze from within Kern County, California, will be allowed immediate access to the refuge with no period of containment. Animals brought from areas outside of Kern County will be subject to a 7 day containment period where grazing cooperator will be required to feed weed free hay.

Monitoring

A monitoring program would be established to provide data on stubble height, residual dry matter, and apparent cover density. This data would establish guidelines for making management decisions concerning the grazing program.

One monitoring site would be established in each management unit on the refuge that is grazed. Each monitoring site selected would be representative of the unit. It would not be near water troughs, salt blocks, roads or fence lines. Once a year, between September 15 and October 15, a monitoring photo would be taken, one 300 foot transect would be run to determine average stubble height, apparent cover density and approximate residual dry matter.

Rainfall would be monitored to determine when enough precipitation has been received to effect germination. This data would be collected at the Kern NWR Complex headquarters weather station and compared with records at the weather monitoring station in Corcoran, California.

Transects would be monitored periodically during the season and near the scheduled turn-off date for stubble height and cover volume.

The monitoring of the habitat along with close adherence to stocking rates and grazing season would provide a sound management program to benefit the species of concern.

Justification: The primary management goals of the refuge are to provide wintering and migration habitat for waterfowl and waterbirds; and to maintain populations and habitats for native plants and animals; and to preserve and improve habitats that support the endangered blunt-nosed leopard lizard, San Joaquin kit fox, and Tipton kangaroo rat. The grazing program is designed to enhance habitat for endangered species, in particular the previously mentioned, residing on the refuge.

While the duration and timing of grazing required for optimal benefits to these species is not fully understood, the decreased vegetation density and removal on non-native plant material are believed to be beneficial. It has been suggested that up to 98% of the biomass comprising California's grassland communities are of non-native plant origin (Menke 1992). Studies on the requirements of Tipton kangaroo rat habitat found that they prefer areas with sparsely scattered woody shrubs with scant to moderate ground cover of grasses and forbs (Williams 1985).

Additionally, San Joaquin kit fox have been found primarily in habitats made of annual grasslands and sparsely vegetated shrubs (O' Farrell 1983). Tollustrup (1983) found that blunt-nosed leopard lizards are found in highest abundance within habitats categorized as San Joaquin saltbush and California prairie plant communities which are comprised of sparse vegetation allowing open areas for basking and searching for prey. With the dramatic change to the plant communities in California over the past 150 years, has come an increase in the density of ground cover due to the introduction of introduced plants (Kuchler 1988). These exotic annual plants have replaced many native bunch grass species, which grew in a more open manner, eliminating small openings native animal species, such as the Tipton kangaroo rat and blunt-nosed leopard lizard, depended for keeping watch for predators and foraging. Declines in rodent populations could also have a negative effect on San Joaquin kit fox which depend on them for food. Moderate grazing of these annual grasslands may be needed to help maintain this habitat in a more open structure which these species require. A limited grazing season (less than 6 months) will also greatly benefit the recovery of native perennials. The benefit of grazing to reduce exotic plant biomass as well as increased seed production and stimulation of native perennial production is well documented (Engler 1995). Stechman (2003) recommends removing cattle no latter than April 30 to reduce selective grazing on the native perennials and native annuals during the seed development stage.

Mandatory Re-evaluation Date (provide month and year):

_____ Mandatory 15 year Re-evaluation Date (for priority uses)

2013 Mandatory 10 year Re-evaluation (for all uses other than priority public uses)

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

_____ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

__X__ Environmental Assessment and Finding of No Significant Impact
The 1985 Environmental Assessment addressed effects associated with the implementation of the Master Plan (1984) for the Kern NWR. *

_____ Environmental Impact Statement and Record of Decision

* The refuge will work under the guidance of the signed Kern NWR Master Plan until the current planning process for the Kern and Pixley National Wildlife Refuge Complex Comprehensive Conservation Plan is complete and witnessed.

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Refuge Determination

Prepared by: _____ _____
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: _____ _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____ _____
(Signature) (Date)

Regional Chief,
National Wildlife
Refuge System: _____ _____
(Signature) (Date)

California/Nevada
Operations Manager _____ _____
(Signature) (Date)

Compatibility Determination

Use: Grazing program to provide suitable habitat for the endangered Tipton kangaroo rat, Blunt-nosed leopard lizard, and San Joaquin kit fox.(Alternative C, Kern and Pixley National Wildlife Refuge Complex Comprehensive Conservation Plan Environmental Assessment)

Refuge Name: Pixley National Wildlife Refuge

Establishing and Acquisition Authorities:

The Pixley National Wildlife Refuge, located in Tulare County, California was established in 1959 under provisions of the Bankhead-Jones Farm Tenant Act (U.S.C. § 1101), Secretarial Order 2843, and the Endangered Species Act of 1973 (16 U.S.C. § 1534).

Refuge Purpose (s):

Bankhead -Jones Farm Tenant Act (7 U.S.C. § 1011)" for purposes of a land conservation and land-utilization program".

Secretarial Order 2843, dated November 17, 1959 "as a refuge for migratory birds and other wildlife".

Endangered Species Act of 1973 (16 U.S.C. § 1534), "to conserve fish, wildlife and plants including those which are listed as endangered species or threatened species".

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

Description of Use: The Pixley National Wildlife Refuge (Refuge) would administer a grazing program on approximately 4,600 acres on 10 units (see attached map). This use has been occurring on the refuge since 1960 (Kern NWRC files). The Refuge would continue to administer this use as outlined in this Compatibility Determination. Although grazing is not identified as a wildlife dependent public use by the National Wildlife Refuge System Improvement Act of 1997, grazing would allow the Refuge to manage the cover of the non-native grasslands . This use would provide short sparse vegetation to provide suitable foraging and denning habitat for endangered San Joaquin kit foxes (*Vulpes macrotis mutica*), blunt-nosed leopard lizards (*Gambelia silus*), and Tipton kangaroo rats (*Dipodomys nitratoides nitratoides*). Habitat is provided in the form of native and introduced grasslands and associated food resources, introduced grasses making up the a higher overall percentage of the short-grass environment.

The optimal time for grazing begins in November and given winter and spring rainfall, may last through late April. Prior to the beginning of the grazing season, an assessment is made by refuge staff to determine the amount of residual dry matter (RDM) available to the cattle. Because grazing on the Refuge benefits endangered species, this RDM level is linked to the needs of the endangered species and not the needs of the cattle. The RDM is determined by clipping, drying, then weighing representative samples of a given unit. RDM values can vary depending on temperature, annual rainfall, and the density of new grass/forb growth. Provided that the amount of RDM is less than [CCP uses 800 lbs/ac]750 lbs./acre, prior to or anytime during the grazing season, the Refuge Manager may request that the permit holder reduce the number of cattle grazing in that unit or remove them all together in order to prevent degradation of the resources in the unit.

Only the grazing of cattle would be considered on the Refuge with the exception of Horse Pasture Unit 1 where horses and mules are grazed through an agreement with National Park Service. Grazing by sheep, goats, or other creatures such as bison would not be considered. During drought years or years of low rainfall, horses, mules, and cattle would not be allowed to graze on the Refuge.

The timing of the placing of cattle on the Refuge, also known as turn in dates (November 1 or slightly later) are adjusted each year based upon the date of the first effective germinating rainfall, and the amount of dry forage available in the fall (Stechman 1995). The timing of removing cattle from the Refuge (turn out dates) is determined solely on the amount of RDM within the unit. If and when 750 lbs[800?] per acre or less is achieved cattle will be removed from the unit.

The unit of measure used to summarize the quantity of cattle grazing on the Refuge is termed Animal Unit Month (AUM). AUM is defined as the amount of forage needed by an “animal unit” (AU) grazing for one month. An AU is defined as one mature 1,000 pound cow and her sucking calf. An assumption in this definition is that a cow nursing her calf will consume about 26 pounds of dry matter per day. Other types of livestock are assigned AUM equivalents based on size and consumption.

The grazing cooperator is chosen following guidance in U.S. Fish and Wildlife Service Refuge Manual under heading 5 RM 17. At the time of this writing, there are no anticipated changes to grazing on the refuge.

Availability of Resources: Assistant refuge managers, under the direction of the project leader, would manage the grazing program. The permittee, working under a Cooperative Land Management Agreement, would accomplish certain facility management and improvement projects under the direction of the assistant manager. Accomplishments would be in direct support to the refuge grazing program and may include maintenance or improvements of existing facilities or installation of new facilities. Projects may include installing and/or maintaining water control structures; fence installation, repair, or removal; sign repair, removal, or installation; gate installation, road, building, or deep well maintenance as well as vegetation control around facilities. The permittee is responsible for the cost of maintenance and/or installation of edifices associated with their grazing permit. Facilities that are installed primarily for refuge purposes are constructed or maintained at refuge expense.

Rates charged per AUM are based on a grazing rate survey of comparable grazing pastures that was conducted in 1995. Each year the current rate is established by adjusting the base rate using a formula created by LaCuesta Consulting that incorporates the average California beef cattle price from the previous year (Stechman 2003). This report was completed in March of 2003 and is updated every five years, all grazing fees are adjusted on a year to year basis based on fluctuations in annual beef prices. Receipts received from permittee(s) at the end of the grazing season are submitted to the General Fund.

At the end of each grazing season, the permittee submits information sufficient for refuge managers to calculate total AUM's for that particular grazing period. When AUM's are calculated, a bill is then submitted to the permittee for collection. Final billing would also take into consideration funds and in kind contributions furnished by each permittee as outlined in their individual Cooperative Land Management Agreements. These work contributions would be deducted on the permittee's final bill with proof of receipt or performed labor. Work contributions of this type would be associated with improvement projects for the particular grazed unit.

The Refuge receives adequate funding to cover the costs associated with management of the grazing program including the RDM assessment conducted at the end of every grazing season. Staff costs associated with this use emanates from the annual review of Special Use Permits, Cooperative Land Management Agreement, and monitoring the impacts of this use as outlined in the Grazing Plan. Annual costs for this use averages $3,000.00. Management of this use also involves monitoring resource impacts associated with this use on the short-grass environments as well as to endangered species.

For a more in depth review of costs associated with this use, the reader is referred to the cost analysis in the Draft Comprehensive Conservation Plan. [I don't think the CCP has any costs associated with this use]

Anticipated Impacts of the Use: To provide this use, the Refuge has adequate biological, administrative, and managerial staff. The grazing program results in both long and short term effects, both negative and positive. The Biological Opinion (BO) for Kern National Wildlife Refuge 1984 Master Plan, identified the following short and long-term negative impacts to wildlife resources from grazing: Trampling of desirable vegetation, disturbances to ground nesting species, trampling of rodent burrows, fencing that may restrict the movements of large animals, and soil compaction especially during wet periods. The BO recommended the following activities to minimize negative impacts associated with grazing: Acquiring additional land with suitable

habitat, allowing the use in years of adequate rainfall only, and supporting grazing within the same unit areas and not moving animals to un-grazed or sensitive areas. Conversely, short and long-term positive impacts include an overall reduction of undesirable, non-native vegetation, as well as the re-establishment of native grass, forb, and shrub communities[is this really an impact of grazing?]. The Refuge was established on land which was previously used for the grazing of cattle and other ungulates. To provide adequate food for the grazing livestock, non-native grasses were seeded and encouraged. At the time of purchase, it was estimated that 85% of the refuge was covered in non-native grasslands. Impacts of cattle to existing water supplies is negligible.

Cattle receive water on the refuge in the following manner as relates to the separate units: Cattle feeding in the Los Feliz unit receive water which is piped into cement water troughs; 40 acre unit cattle receive water through a water tank located within the grazing unit, water is brought in via truck to pipelines located off refuge which feed the tank; Dickey Tract cattle have water supplied from a well off refuge brought in through a pipeline to a cattle trough; Horse Pasture units 1 and 2, Centerfield, Two Well, 200 Acre, and Deer Creek units West and East obtain water from refuge owned wells and piped into a series of cement water troughs.

While studies to determine the effects of grazing on local threatened and endangered species have been conducted on the Refuge and surrounding lands in the Southern San Joaquin Valley, and these studies have indicated a benefit from decreased vegetative cover to these species (Williams 1985 and O'Farrell 1983), the duration and timing needed for optimal benefits is poorly understood. These studies have been conducted annually on lands surrounding the refuge, but strong evidence to support a result which indicate a positive correlation have not been forthcoming. [not sure what this means] Part of the blame for a lack of strong correlative evidence is placed on an inconsistent annual rainfall, where a consistent average rainfall would support data indicating either positive or negative impacts to local species from grazing.

Vernal pools are of a special concern on the Refuge. Cattle and horses would be excluded from these habitats

Additionally, cattle are grazed in areas which are open to the public and also in direct view of the general public. The use of grazing as a management tool on the Refuge is described in an interpretive pamphlet accessible to the public at the Refuge.

The 1984 Master Plan identifies the need to develop additional information relating to the effects of grazing on local endangered species. While the effects have been determined to be positive, additional research and evaluation would allow the refuge to refine its management strategies and objectives for grassland management.

Public Review and Comment: During completion of the Master Planning process of 1984, the grazing program underwent public review. A notice of Proposed Action was issued as well as informational news letters and four news releases. Public open houses have been held at various times to accept comments on the grazing program. As part of the Comprehensive Conservation Planning process, a public review and comment period will be included during which time the current grazing program and proposed minor changes will undergo public scrutiny.

Determination (Check one Below)

_____ Use is not compatible _____X____ **Use is compatible, with Stipulations**

Stipulations Necessary to Ensure Compatibility: The Cooperator is operating under the terms and conditions of a Cooperative Land Management Agreement, Special Use Permit, and an existing Refuge Grazing Plan. These documents provide the necessary information and assistance from the refuge to determine start and end dates for cattle placement and removal.

Additional Stipulations are as follows:

It will be the responsibility of the refuge manager to determine fair market value of grazing, to issue special use permits, monitor permittee compliance, and maintain up-to-date files on all grazing activities.

In order to minimize the amount of new noxious weeds being introduced to the refuge, cattle, horses, and mules brought to the refuge to graze from within Tulare County, California, will be allowed immediate access to the refuge with no period of containment. Animals brought from areas outside of Tulare County will be subject to a 7 day containment period where grazing cooperator will be required to feed weed free hay.

Cattle and horses will be fenced out of vernal pools on the refuge to eliminate any adverse impacts.

Monitoring

A monitoring program will be established to provide data on stubble height, residual dry matter, and apparent cover density. This data would establish guidelines for making management decisions concerning the grazing program.

Depending on the total acreage of each grazing unit, an minimum of 2 monitoring sites will be established in each management unit on the Refuge that is grazed. Each monitoring site selected will be representative of the unit. It will not be near water troughs, salt blocks, roads or fence lines. Once a year, between September 15 and October 15, a monitoring photo will be taken, one 300 foot transect will be run to determine average stubble height, apparent cover density and approximate residual dry matter.

Rainfall will be monitored to determine when enough precipitation has been received to effect germination. This data will then be collected at the Kern NWR Complex headquarters weather station and compared with records at the weather monitoring station in Corcoran, California.

Transects will be monitored periodically during the season and near the scheduled turn-off date for stubble height and cover volume.

The monitoring of the habitat along with close adherence to stocking rates and grazing season would provide a sound management program to benefit the species of concern.

Justification: The primary management goals of the refuge are to provide wintering and migration habitat for waterfowl and waterbirds; provide for public use which is compatible with refuge and US. Fish and Wildlife Service objectives and to encourage environmental education for visitors; to maintain populations and habitats for native plants and animals; and to preserve and improve habitats that support the endangered blunt-nosed leopard lizard, San Joaquin kit fox, and Tipton kangaroo rat. The grazing program is designed to enhance habitat for endangered species, in particular the previously mentioned, residing on the refuge.

While the duration and timing of grazing required for optimal benefits to these species is not fully understood, the decreased vegetation density and removal on non-native plant material are believed to be beneficial. It has been suggested that up to 98% of the biomass comprising California's grassland communities are of non-native plant origin (Menke 1992). Studies on the habitatrequirements of Tipton kangaroo rat habitat found that they prefer areas with sparsely scattered woody shrubs with scant to moderate ground cover of grasses and forbs (Williams 1985). Additionally, San Joaquin kit fox have been found primarily in habitats made of annual grasslands and sparsely vegetated shrubs (O' Farrell 1983). Tollustrup (1983) found that blunt-nosed leopard lizards are found in highest abundance within habitats categorized as San Joaquin saltbush and California prairie plant communities which are comprised of sparse vegetation allowing open areas for basking and searching for prey. With the dramatic change to the plant communities in California over the past 150 years, has come an increase in the density of ground cover due to the introduction of introduced plants (Kuchler 1988). These exotic annual plants have replaced many native bunch grass species, which grew in a more open manner, eliminating small openings native animal species, such as the Tipton kangaroo rat and blunt-nosed leopard lizard, depended for keeping watch for predators and foraging. Declines in rodent populations could also have a negative effect on San Joaquin kit fox which depend on them for food. Moderate grazing of these annual grasslands may be needed to help maintain this habitat in a more open structure which these species require. A limited grazing season (less than 6 months) will also greatly benefit the recovery of native perennials. The benefit of grazing to reduce exotic plant biomass as well as increased seed production and stimulation of native perennial production is well documented (Engler 1995). Stechman (2003) recommends removing cattle no latter than April 30 to reduce selective grazing on the native perennials and native annuals during the seed development stage.

Mandatory Re-evaluation Date (provide month and year):

_____ Mandatory 15 year Re-evaluation Date (for priority uses)

2013 Mandatory 10 year Re-evaluation (for all uses other than priority public uses)

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

_____ Categorical Exclusion without Environmental Action Statement
_____ Categorical Exclusion and Environmental Action Statement

__X__ Environmental Assessment and Finding of No Significant Impact
The 1985 Environmental Assessment addressed effects associated with the implementation of the Master Plan (1984) for the Kern NWR. *

_____ Environmental Impact Statement and Record of Decision

* The refuge will work under the guidance of the signed Kern NWR Master Plan until the current planning process for the Kern and Pixley National Wildlife Refuge Complex Comprehensive Conservation Plan is complete and witnessed.

Literature Cited

1962. Kern National Wildlife Refuge Complex Annual Narrative. Kern NWRC files.

1982. Overview of Cultural Resources, Kern and Pixley National Wildlife Refuges, California. Marcus R. Arguelles and Michael J. Moratto. Infotec. Kern NWRC files.

1985. Master Plan, Kern National Wildlife Refuge.

1985. Biological Opinion, Master Plan, Kern National Wildlife Refuge.

1998. Effects of Grazing/Non-Grazing Regimes on Fauna and Flora. Joseph Engler, Kern NWRC files.

2000. Cultural Resources Review for Comprehensive Conservation Planning. US Fish and Wildlife Service, Region 1, Cultural Resources Team. Kern National Wildlife Refuge Complex files.

2000. Results of Buena Vista Lake ornate shrew and Tipton kangaroo Rat Trapping at the Kern National Wildlife Refuge. Kern NWRC files.

2000. Effects of Grazing on Endangered and Threatened Species in Southern Kern County, California. Endangered Species Recovery Program.

2003. Periodic Reappraisal of Beef Cattle and Grazing Fee Base Rate Prices and Recommendations for Monitoring. Prepared for Kern NWR by John V. Stechman, Certified Consultant. Consulting in the Natural Environmental and Agricultural Resources, Avila Beach, California.

2003. Draft Comprehensive Conservation Plan. Kern and Pixley National Wildlife Refuge Complex.

Refuge Determination:

Prepared by: _____ _____
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: _____ _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____ _____
(Signature) (Date)

Regional Chief,
National Wildlife
Refuge System: _____ _____
(Signature) (Date)

California/Nevada
Operations Manager
(for CA and NV) _____ _____
(Signature) (Date)

Compatibility Determination

Use: Research (Alternative C, Kern and Pixley National Wildlife Refuge Complex comprehensive Conservation Plan Environmental Assessment)

Refuge Name: Kern National Wildlife Refuge

Establishing and Acquisition Authorities:

The Kern National Wildlife Refuge, located in Kern County, California, was established November 18, 1960, under the provisions of the Migratory Bird Conservation Act (16 U.S.C.§ 715d).

Refuge Purpose (s):

Migratory Bird Conservation Act "for use as an inviolate sanctuary, or for any other management purpose, for migratory birds." (16 U.S.C.§71sd)

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

Description of Use: The Kern National Wildlife Refuge (refuge), receives periodic requests to conduct research from various universities, research groups; federal, state, and county agencies; as well as environmental consulting firms. Although research is not identified as a wildlife dependent public use by the National Wildlife Refuge System Improvement Act of 1997, scientific research can benefit refuge resources and support the purpose of the refuge and mission of the National Wildlife Refuge System. The refuge proposes to give priority to studies that contribute to the enhancement, protection, use, preservation, and management of native refuge wildlife populations and their habitats specifically that of the endangered Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*), Buena Vista Lake ornate shrew (*Sorex ornatus relictus*), San Joaquin kit fox (*Vulpes macrotis mutica*), and blunt-nosed leopard lizard (*Gambelia sila*).

Other researchers conducting studies and investigations on the Refuge include those from universities, graduate students collecting data, as well as other Fish and Wildlife Service personnel from other offices and stations. Research conducted to collect baseline information would include, but is not limited to, mist netting and banding avian species; census counts via transects, mark-recapture using small mammal traps, pit traps for reptiles, or determining habitat suitability through various vegetation sampling methods.
Research activities would occur on the refuge throughout the year and during daylight and night time hours. All habitat types of the refuge would be open to research including upland areas, moist soil, seasonal wetland, and riparian. The duration of research studies would vary as length of

investigations would be dependant upon the type of question being posed and impacts to areas resulting in extended human traffic.

All research applicants would be required to submit a proposal summarizing the following:

1. Objectives of the study;

2. Justification for the study;

3. Detailed study methodology and schedule;

4. Potential impact on refuge wildlife and/or habitats, including short- and long-term disturbance, injury, and mortality; and measures taken in designing the study to avoid and minimize these impacts:

5. Research personnel required and their qualifications/experience;

6. Status of necessary permits (i.e., scientific collecting permits, migratory bird, as well as federal and state endangered species permit);

7. Costs to refuge and refuge staff time requested, if any; and

8. Anticipated end products (i.e., reports, publications).

Research proposals would be reviewed by refuge staff and others, as appropriate. The following criteria would be used to assess research proposals:

1. Research that would contribute to enhancing refuge management would have higher priority than other requests.

2. Research that would conflict with other ongoing research, monitoring, or management programs would not be approved.

3. Research projects that can be carried out elsewhere (off-refuge) would be less likely to be approved.

4. Research that causes undue disturbance or is intrusive would not be approved. The degree and type of disturbance would be carefully weighed when evaluating a research request; many threatened and endangered species as well as migratory birds, and other species residing on the refuge, such as Buena Vista Lake ornate shrew, are sensitive to disturbance and habitats, in particular their habitat of woodland litter in riparian areas.

5. Evaluation of research requests would determine whether any effort has been made to minimize disturbance through study design (for example, by considering adjustments in the location, timing, or scope of the study; the number of participants, study methods, the number of study sites, etc.).

6. If it would be impossible for the Refuge to monitor researcher activities because of staffing or logistical constraints, requests for research may be denied, depending on the circumstances.

7. The duration of the project would be considered and agreed upon before approval. All projects would be reviewed annually to assess whether they continue to meet these criteria (and others as deemed necessary), will continue to operate as originally proposed, and are contributing to the objectives of the study.

Approved research projects would be conducted under a refuge-issued Special Use Permit with case-specific stipulations.

Availability of Resources: Adequate funding and staff exists to monitor and oversee research at the refuge. Administrative staff costs associated with this use consist of refuge staff time to review research proposals, collected data, special use permits, research summaries, and to evaluate impacts and that researchers are in compliance. Other staff time includes monitoring the use of the refuge temporary quarters where researchers are allowed to stay during their data collection period if space is available. Annual monetary costs expended by the refuge to administer this use averages $1,000.00. Most of the research conducted on the refuge in the past has been funded from outside sources and for purposes of this proposed use is likely to remain the same.

Anticipated Impacts of the Use:

Threatened and Endangered: Human activity has had adverse impacts on threatened and endangered species found in the Southern San Joaquin Valley (Germano and Williams, 1993, Williams 1995, and Orloff et al. 1986). These studies identified adverse impacts to these species as a result of increased agriculture, urbanization, and changes in water use within the species range;

disturbances of a small number of humans working near areas of endangered species, as would be the case pertaining to this use, would be inconsequential.

Resident wildlife, including threatened and endangered species, could be temporarily disturbed which may be due to the placing and/or retrieval of investigative equipment, working in close proximity to the species, and the temporary handling of species. As studies will follow an approved investigative or current protocol method, as stated in the Stipulations section of this document, impacts to wildlife would be considered minimal.

Migratory Birds: Human activity involved with this use may disturb migratory birds utilizing the refuge's habitats primarily during feeding and breeding activities (Korschgen and Dahlgren 1992). Human motion near wetland habitats could disturb migratory birds, including black-necked stilt (*Himantopus mexicanus*), American avocet (*Recurvirostra americana*), and various waterfowl species (*Anas* spp.) which choose to breed on the refuge. Refuge staff as well as researchers permitted on the refuge are trained to minimize disturbances to resident and migratory wildlife. Training includes avoiding active nest areas and areas favorable to loafing during waterfowl hunt season, as well as reducing impacts to habitats.

Habitats: Minimal impact on the Refuge wildlife and habitats is anticipated during research studies. Some level of disturbance is expected with research activities, because most researchers would possibly be entering areas that are normally closed to the public and likely collecting samples or handling plants or wildlife. Special Use Permits would include conditions to ensure that impacts on wildlife and habitats are reduced as much as possible. Impacts to vegetation would be minimal and would not involve earthwork or cutting associated with reducing obstacles that impedes movement to and from data collection sites. Movement to and from data collection sites would remain the same throughout the study period.

Cultural Resources: Research studies are not likely to impact cultural resources on the refuge. Most sites containing cultural resources are known to refuge management and would be considered when reviewing of research proposals in order to insure activities associated with this use does not result in negative impacts.

Public Review and Comment: During completion of the Master Planning process of 1984, this use underwent public review. A notice of Proposed Action was issued as well as informational news letters and four news releases. As part of the Comprehensive Conservation Planning process, a public review and comment period will be included during which time this use and proposed minor changes will undergo public scrutiny.

Determination (Check one Below)

_____ Use is not compatible _____X____ Use is compatible

Stipulations Necessary to Ensure Compatibility:

Any researcher requesting to conduct research on the refuge will be required to submit a study proposal.

All work will be coordinated with the project leader, or designated refuge staff, and researcher.

Vehicles will be operated only on established and designated refuge roads and operated at the posted speed limit.

Research will adhere to current protocol for the data on particular individual species collected.

Proposed research methods which will adversely affect, or would have the potential to adversely affect refuge resources will require the researcher to develop mitigation measures to minimize potential impacts; mitigation measures will be listed as a condition in the Special Use Permit.

Refuge staff will be free to accompany researchers at any time to assess potential impacts; to insure Special Use Permits are adhered to; and to determine if approved research proposals and Special Use Permits should be terminated because of adverse impacts.

All refuge rules and regulations must be followed unless otherwise excepted, in writing, by project leader.

Special Use Permits are valid for only one year. Renewal of such permits will be granted once refuge management has reviewed the validity of previously collected data, as well insuring all necessary permits have been updated.

The researcher will be responsible for acquiring all necessary permits, both from the State of California or U.S. Fish and Wildlife Service, if applicable, and to demonstrate that these permits are up to date prior to the beginning of research approval.

All research studies undertaken will provide current biological information on the needs and limitations of refuge resources (wildlife or habitats).

Justification: Information will be directly applicable to management and recovery of threatened and endangered species of the Southern San Joaquin Valley found on the refuge. The anticipated level of research to be conducted on the Refuge at any given time would be compatible because the refuge would ensure that research proposals support the purpose of the refuge and mission of the National Wildlife Refuge System. In view of the impacts research activities may have on the U. S. Fish and Wildlife Service's ability to achieve the refuge purpose, sufficient restrictions will be placed on the researcher to ensure that disturbance is kept to an acceptable level.

Mandatory Re-Evaluation Date (provide month and year):

_____ Mandatory 15-year Re-Evaluation Date (for priority public uses)

___2014_ Mandatory 10-year Re-Evaluation Date (for all uses other priority public uses)

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

_____ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

__X__ Environmental Assessment and Finding of No Significant Impact
The 1985 Environmental Assessment addressed effects associated with the implementation of the Master Plan (1984) for the Kern NWR. *

_____ Environmental Impact Statement and Record of Decision

* The refuge will work under the guidance of the signed Kern NWR Master Plan until the current planning process for the Kern and Pixley National Wildlife Refuge Complex Comprehensive Conservation Plan is complete and witnessed.

Literature Cited:

1982. Overview of Cultural Resources, Kern and Pixley National Wildlife Refuges, California. Marcus R. Arguelles and Michael J. Moratto. Infotec. Kern NWRC files.

1985. A Review of the Population Status of the Tipton Kangaroo Rat, Dipodomys nitratoides nitratoides. U. S. Fish and Wildlife Service, Sacramento, Non-game Wildl. Invest., Final Rep. E-W-R, IV-10.0 48 pp.

1986. S. G. Orloff, F. Hall, and L. Spiegel. Distribution and Habitat Requirements of the San Joaquin Kit Fox in the Northern Extreme of Their Range. Trans. West. Sect. Wildl. Soc. 22:60-70.

1992. C. E. Korschgen and R. B. Dahlgren. Human Disturbances of Waterfowl: Causes, Effects, and Management.

1993. D. J. Germano and D. F. Williams. Recovery of the Blunt-nosed Leopard Lizard: Past Efforts, Present Knowledge, and future Opportunities. Trans. West. Sec. Wildl. Soc. 28:38-47.

2000. Cultural Resources Review for Comprehensive Conservation Planning. US Fish and Wildlife Service, Region 1, Cultural Resources Team. Kern National Wildlife Refuge Complex files.

Refuge Determination:

Prepared by: _____ _____
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: _____ _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____ _____
(Signature) (Date)

Regional Chief,
National Wildlife
Refuge System: _____ _____
(Signature) (Date)

California/Nevada
Operations Manager _____ _____
(Signature) (Date)

Compatibility Determination

Use: Research (Alternative C, Kern and Pixley National Wildlife Refuge Complex comprehensive Conservation Plan Environmental Assessment)

Refuge Name: Pixley National Wildlife Refuge

Establishing and Acquisition Authorities:

The Pixley National Wildlife Refuge, located in Tulare County, California, was established on November 17, 1959, under the provisions of the Bankhead-Jones Farm Tenant Act (U.S.C. § 1101), Secretarial Order 2843, and the Endangered / Species Act of 1973 (16 U.S.C. § 1534).

Refuge Purpose (s):

Bankhead -Jones Farm Tenant Act (7 U.S.C. § 1011 "for purposes of a land conservation and land-utilization program".

Secretarial Order 2843, dated November 17, 1959 "as a refuge for migratory birds and other wildlife".

Endangered Species Act of 1973 (16 U.S.C. § 1534) "to conserve fish, wildlife and plants including those which are listed as endangered species or threatened species".

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

Description of Use: The Pixley National Wildlife Refuge (Refuge), receives periodic requests to conduct research from various universities, research groups; federal, state, and county agencies; as well as environmental consulting firms. Although research is not identified as a wildlife dependent public use by the National Wildlife Refuge System Improvement Act of 1997, scientific research can benefit Refuge resources and support the purpose of the Refuge and mission of the National Wildlife Refuge System. The refuge proposes to prioritize studies that contribute to the enhancement, protection, use, and management of native refuge wildlife populations and their habitats specifically that of the endangered Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*), San Joaquin kit fox (*Vulpes macrotis mutica*), and blunt-nosed leopard lizard (*Gambelia sila*).

While the Refuge has received requests to conduct research from various entities, the vast majority of research conducted is done by the Endangered Species Recovery Program (ESRP). ESRP is a research group which started in 1992 primarily to conduct research on endangered

plants and animals in the San Joaquin Valley and surrounding areas and to identify population trends. This overall program is part of mitigation required of the Bureau of Reclamation (BOR) by the USFWS for renewal by BORs water contracts in the Friant Water Service Area of the eastern San Joaquin Valley. Part of the primary focus of this program is to gather seasonal data on the endangered Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*) and blunt-nosed leopard lizard (*Gambelia sila*) on the refuge.

Other researchers conducting studies and investigations on the Refuge include those from universities, graduate students collecting data, as well as Fish and Wildlife Service personnel from other offices and stations. Research conducted to collect baseline information would include, but is not limited to: mist netting and banding avian species, census counts via transects, mark-recapture using small mammal traps, pit traps for reptiles, or determining habitat suitability through various vegetation sampling methods.

Research activities would occur on the Refuge throughout the year and during daylight and night time hours. All habitat types of the Refuge would be open to research including upland areas, moist soil, seasonal wetland, and riparian. The duration of research studies would vary as length of investigations would be dependant upon the type of question being posed and impacts to areas resulting in extended human traffic.

All research applicants would be required to submit a proposal summarizing the following:

1. Objectives of the study;

2. Justification for the study;

3. Detailed study methodology and schedule;

4. Potential impact on Refuge wildlife and/or habitats, including short- and long-term disturbance, injury, and mortality; and measures taken in designing the study to avoid and minimize these impacts:

5. Research personnel required and their qualifications/experience;

6. Status of necessary permits (i.e., scientific collecting permits, migratory bird, as well as federal and state endangered species permit);

7. Costs to Refuge and Refuge staff time requested, if any; and

8. Anticipated end products (i.e., reports, publications).

Research proposals would be reviewed by refuge staff or others, as appropriate. The following criteria would be used to assess research proposals:

1. Research that would contribute to enhancing refuge management would have higher priority than other requests.

2. Research that would conflict with other ongoing research, monitoring, or management programs would not be approved.

3. Research projects that can be carried out elsewhere (off-refuge) would be less likely to be approved.

4. Research that causes undue disturbance or is intrusive would not be approved. The degree and type of disturbance would be carefully weighed when evaluating a research request. Threatened and endangered species, and special status species such as the spadefoot toad (*Spea hammondii*), as well as feeding and breeding birds are sensitive to disturbance and would require special attention. .

5. Evaluation of research requests would determine whether efforts will be made to minimize disturbance through study design (for example, by considering adjustments in the location, timing, or scope of the study; the number of participants, study methods, the number of study sites, etc.).

6. If it would be impossible for refuge staff to monitor researcher activities because of staffing or logistical constraints, requests for research may be denied, depending on the circumstances.

7. The duration of the project would be considered and agreed upon before approval. All projects would be reviewed annually to assess whether they continue to meet these criteria (and others as deemed necessary), continue to operate as originally proposed, and are contributing to the objectives of the study.

Approved research projects would be conducted under a refuge-issued Special Use Permit with case-specific stipulations.

Availability of Resources: Adequate funding and staff exists to manage for research at Pixley National Wildlife Refuge. Administrative staff costs associated with this use consists of Refuge staff time to review research proposals, collected data, special use permits, research summaries, and to evaluate impacts and that researchers are in compliance. Other staff time includes monitoring the use of the Refuge temporary quarters where researchers are allowed to stay during their data collection period if space is available. Annual monetary costs expended by the Refuge to administer this use averages $1,000.00. Most of the research conducted on the Refuge in the past has been funded from outside sources and this trend is expected to continue.

Anticipated Impacts of the Use:

Threatened and Endangered: Human activity has had adverse impacts on threatened and endangered species found in the southern San Joaquin Valley (Germano and Williams, 1993, Williams 1995, and Orloff et al. 1986). These studies identified adverse impacts to these species as a result of increased agriculture, urbanization, and changes in water use within the species range; disturbances of a small number of humans working near areas of endangered species, as would be the case pertaining to this use, would be inconsequential.

Resident wildlife, including threatened and endangered species, could be temporarily disturbed which may be due to the placing and/or retrieval of equipment, working in close proximity to the species, and the temporary handling of species. As studies will follow an approved investigative or current protocol method, as stated in the Stipulations section of this document, impacts to wildlife would be considered minimal.

Vernal Pools: The potential for researchers to trample and destroy vernal pool habitats in of concern, particularly during wet season, when vernal pools are at their most productive. To eliminate this type of impact, vernal pools are fenced from human entry.

Migratory Birds: Human activity may disturb migratory birds utilizing the Refuge's habitats primarily during feeding and breeding activities (Korschgen and Dahlgren 1992). Human activities near the wetland habitats could disturb feeding and nesting migratory birds, including sandhill cranes (*Grus canadensis*), mountain plovers (*Charadrius montanus*), black-necked stilt (*Himantopus mexicanus*), American avocet (*Recurvirostra americana*), and various waterfowl species (*Anas* spp.) which choose to breed on the refuge. Refuge staff as well as researchers permitted on the refuge are trained to minimize disturbances to resident and migratory wildlife. Training includes avoiding active nest areas, areas favorable to loafing during waterfowl hunt season, and reducing impacts to habitats.

Habitats: Minimal impact on the Refuge's wildlife and habitats is anticipated during research studies. Some level of disturbance is expected with research activities, because most researchers would possibly be entering areas that are normally closed to the public and likely collecting samples or handling plants or wildlife. Special Use Permits would include conditions to ensure that impacts on wildlife and habitats are reduces as much as possible. Impacts to vegetation would be minimal and would not involve earthwork or cutting associated with reducing obstacles that impedes movement to and from data collection sites. Movement to and from data collection sites would remain the same throughout the study period.

Cultural Resources: This use is not likely to impact cultural resources on the refuge. Most sites containing cultural resources are known to refuge management and would be considered when reviewing of research proposals in order to insure activities associated with this use does not result in negative impacts.

Public Review and Comment: During completion of the Master Planning process of 1984, this use underwent public review. A notice of Proposed Action was issued as well as informational news letters and four news releases. As part of the Comprehensive Conservation Planning process, a public review and comment period will be included during which time this use and proposed minor changes will undergo public scrutiny.

Determination (Check one Below)

_____ Use is not compatible _____X____ Use is compatible

Stipulations Necessary to Ensure Compatibility:

Any researcher will be required to submit a study plan.

All work will be coordinated with the project leader, or designated refuge staff, and researcher.

Vehicles will be operated only on established and designated refuge roads and operated at the posted speed limit.

Research will adhere to current protocol for the data to be collected.

Proposed research methods which will adversely affect, or would have the potential to adversely affect refuge resources will require the researcher to develop mitigation measures to minimize potential impacts; mitigation measures will be listed as a condition in the Special Use Permit.

Refuge staff will be free to accompany researchers at any time to assess potential impacts; to insure Special Use Permits are adhered to; and to determine if approved research proposals and Special Use Permits should be terminated because of adverse impacts.

All refuge rules and regulations must be followed unless otherwise excepted, in writing, by project leader.

Special Use Permits are valid for only one year. Renewal of such permits will be granted once refuge management has reviewed the validity of previously collected data, as well insuring all necessary permits have been updated.

The researcher will be responsible for acquiring all necessary permits, both from the State of California or U.S. Fish and Wildlife Service, if applicable, and to demonstrate that these permits are up to date prior to the beginning of research approval.

All research studies undertaken to provide current biological information on the needs and limitations of refuge resources (wildlife or habitats).

Justification: Information will be directly applicable to management and recovery of threatened and endangered species of the Southern San Joaquin Valley found on the Refuge. The anticipated level of research to be conducted on the Refuge at any given time would be compatible because the Refuge would ensure that research proposals support the purpose of the Refuge and mission of the System. In view of the impacts research activities may have on the Service's ability to achieve the Refuge purpose, sufficient restrictions will be placed on the researcher to ensure that disturbance is kept at an acceptable level.

Mandatory Re-Evaluation Date (provide month and year):

_____ Mandatory 15-year Re-Evaluation Date (for priority public uses)

___2014_ Mandatory 10-year Re-Evaluation Date (for all uses other priority public uses)

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

_____ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

__X___ Environmental Assessment and Finding of No Significant Impact

The 1985 Environmental Assessment addressed effects associated with the implementation of the Master Plan (1984) for the Kern NWR. *

_____ Environmental Impact Statement and Record of Decision

* The refuge will work under the guidance of the signed Kern NWR Master Plan until the current planning process for the Kern and Pixley National Wildlife Refuge Complex Comprehensive Conservation Plan is complete and witnessed.

Literature Cited:

Arguelles, Marcus R. and Michael J. Moratto. 1982. Overview of Cultural Resources, Kern and Pixley National Wildlife Refuges, California.Kern NWRC files.

U. S. Fish and Wildlife Service. 1985. A Review of the Population Status of the Tipton Kangaroo Rat, *Dipodomys nitratoides nitratoides*. Non-game Wildl. Invest., Final Rep. E-W-R, IV-10.0 48 pp.

Orloff, S.G., F. Hall, and L. Spiegel. 1986. Distribution and Habitat Requirements of the San Joaquin Kit Fox in the Northern Extreme of Their Range. Trans. West. Sect. Wildl. Soc. 22:60-70.

Korschgen, C.E. and R. B. Dahlgren. 1992. Human Disturbances of Waterfowl: Causes, Effects, and Management.

Germano, D. J. and D. F. Williams. 1993. Recovery of the Blunt-nosed Leopard Lizard: Past Efforts, Present Knowledge, and future Opportunities. Trans. West. Sec. Wildl. Soc. 28:38-47.

US Fish and Wildlife Service. 2000. Cultural Resources Review for Comprehensive Conservation Planning. Region 1, Cultural Resources Team. Kern National Wildlife Refuge Complex files.

Refuge Determination:

Prepared by: _____ _____
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: _____ _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____ _____
(Signature) (Date)

Regional Chief,
National Wildlife
Refuge System: _____ _____
(Signature) (Date)

California/Nevada
Operations Manager _____ _____
(Signature) (Date)

Compatibility Determination

Use:	Monitor and control mosquitoes
Refuge Name:	Kern National Wildlife Refuge (Established November 18, 1960)
Establishing and Acquisitiion Authority:	The Kern National Wildlife Refuge, located in Kern County, California was established in 1960 under provisions of the Migratory Bird Conservation Act (16 U.S.C. ‘ 715d).
Refuge Purpose(s):	Migratory Bird Conservation Act (16 U.S.C. ‘ 715d) “…inviolate sanctuary, or for any other management purpose, for migratory birds.”

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

Description of Use: The Kern Mosquito Vector Control District (KMVCD) proposes to continue using Kern National Wildlife Refuge (Refuge) for monitoring and controlling mosquitoes to address human health concerns of neighboring communities. The Refuge is located in the Southern San Joaquin Valley and within the historic Tulare Lake Basin. The community of Lost Hills lies 6 miles southwest of the Refuge, the community of Delano lies 16 miles east of the Refuge, the community of Wasco lies 16 miles to the southeast, and the community of Corcoran lies 20 miles to the north. The city of Bakersfield is about 40 miles to the southeast. Nearer to the refuge there are small private duck clubs which are occupied on a fairly constant basis from late summer into early spring. Private residences for ranchers and farm workers are scattered in this rural area. Residents of Kern County have voiced concern about biting mosquitoes and mosquito-borne disease. To address these concerns the KMVCD has been monitoring and controlling mosquitoes on the refuge since 1983.

While mosquitoes are considered a nuisance because of their biting, many species are known vectors of serious diseases in California. Although 12 mosquito-borne viruses are known to occur in California, only western equine encephalomyelitis virus (WEE) and St. Louis encephalitis virus (SLE) have caused significant outbreaks of human disease (CA Dept. of Health Services 2003). California is also at risk for West Nile virus (WNV) which was first detected in the summer of 2003 in adult mosquitoes in Imperial County, and in crows in Orange County.
WEE tends to be most serious in very young children, whereas elderly people are most at risk to SLE and WNV (CA Dept. of Heath Services 2003). WEE and WNV can cause serious diseases in horses and emus, and WNV kills a wide variety of endemic and imported birds. Mosquito control is the only known practical method of protecting people and animals from WEE, SLE, and WNV (CA Dept. of Health Services 2003).

The mosquito species identified by KMVCD for monitoring and control are *Culex erythrothorax*, *Cx. pipiens*, *Cx. tarsalis*; *Ochlerotatus dorsalis*, *Oc. melanimon*, *Oc. nigromaculis*, and *Aedes vexans*. *Culex tarsalis* is the primary vector of WEE and SLE in California and is also considered to be a significant vector of WNV (CA Dept. of Health Services 2003). *Culex pipiens, Cx. erythrothorax*, *Ochlerotatus melanimon, Oc. dorsalis,* and *Aedes vexans* may also contribute to disease transmission (Goddard 2002).

Mosquito Monitoring

KMVCD monitoring activities are designed to estimate the abundance of immature (larvae and pupae) and adult mosquito populations. During an average mosquito monitoring period, typically between the months of April through October, KMVCD assesses larval mosquito populations by using the 'dipper' method in various wetlands, moist soil, and riparian areas. Adults are monitored using carbon dioxide (CO2) and light traps. Monitoring is conducted through a Special Use Permit (SUP) between KMVCD and the Refuge.

KMVCD monitors larval stage mosquito populations and identifies species using the dipper method. This entails using a long-handled ladle (ca 500 ml) called a dipper to collect water samples from pools potentially serving as mosquito sources. Dipping would occur about every two weeks wherever there are pools of water. Whenever water levels are changing on the Refuge, due to flooding-up or drawing-down specific units, dipping occurs weekly. Dip counts are used to estimate the numbers of immature mosquitoes and to determine the need for mosquito control. Captured immature mosquitoes would be identified taxonomically by skilled technicians.

All Refuge wetland units could potentially be monitored using the dipper method. However, the areas of Refuge wetland units that are potential mosquito habitat would be targeted. Target areas would include wetland margins, shorelines, and riparian areas.

KMVCD proposes to use carbon dioxide (CO2) baited traps to monitor density of adult mosquitoes and to identify adults to species. The trap used is baited with 1-2 kg of dry ice next to the trap. A motor and fan on the 3 inch diameter trap sucks mosquitoes down into a container like a modified gallon ice cream carton with tubular surgical stockinet attached to the bottom of the motor housing unit to retain the collected mosquitoes. The trap uses a 6v battery.

Placement of CO2 baited traps on the Refuge depends on host-seeking patterns of the target species. *Culex tarsalis* primarily bloodfeed on birds and mammals, and therefore hunt along vegetative borders and tree canopies where birds roost and nest. *Culex erythrothorax* are best collected within wetland areas near dense stands of tules and cattails. *Ochlerotatus melanimon* and *Oc. nigromaculis* are mammal feeders and typically hunt over open fields.

Six traps are deployed from April through October. In 2003 traps were monitored from March through November. In 2004, traps were set up at the beginning of March and may be run through the entire year. Traps are checked at least every two weeks. During peak mosquito activity traps would be checked more frequently.

A single light trap has been run at Refuge headquarters, and checked weekly throughout the year. Light traps are cylinders with a light, fan, and collecting jar. The mosquitoes are attracted to the light and enter the cylinder. The fan creates an air current that moves the mosquitoes into the collecting jar. The light trap is mounted on the shop building at headquarters.

As part of monitoring conducted by KMVCD for the presence of these viruses, a sentinel chicken flock is maintained in a pen on the Refuge. Sentinel chickens are exposed to the environment and to mosquitoes moving through the area that may choose to feed on them. Regular blood samples are periodically taken from the chickens to detect any mosquito-vector pathogen activity.

The monitoring activities described above are conducted under a SUP between the Refuge and KMVCD. The Refuge proposes to allow the KMVCD to continue these activities under an annual SUP.

In addition, the Refuge has an SUP with the Bakersfield arbovirus field station of the U.C. Davis Center for Vector-borne Disease Research. Staff of the field center periodically mist-net in designated areas to monitor resident, transient, and migratory birds, mainly small passerine species. Mist-netted avian species are banded and also have blood taken to detect the presence of any mosquito-vector pathogen activity. Mist netting/banding activities are conducted under this SUP. The Refuge proposes to allow the U.C. Davis arbovirus field station to continue these activities under an annual SUP.

Mosquito Control with larvicides:

The KMVCD proposes to control mosquitoes by treating areas infested with larval stages of *Culex erythrothorax*, *Cx. pipiens*, *Cx. tarsalis*; *Ochlerotatus dorsalis*, *Oc. melanimon*, *Oc. nigromaculis*, and *Aedes vexans*. Mosquito control would be initiated with the use of larvicides when an average of one or more larvae are captured per dip. KMVCD proposes to treat larval mosquitoes using *Bacillus thuringiensis* serovar. *israelensis* (Bti) and methoprene, which would be applied in multiple treatments using aerial and ground application methods.

Bti is a microbial insect pathogen used to control larval stages of mosquitoes and black flies. It is a naturally occurring anaerobic spore forming bacteria that is mass produced using modern fermentation technology. Bti produces protein endotoxins that are activated in the alkaline mid-gut of insect species and subsequently bind to protein specific receptors of susceptible insect species resulting in the lethal response (Lacey and Mulla 1990). Bti must therefore be ingested by the target insect to be effective. It is most effective on younger mosquito larval instars but does not affect pupae or adult mosquitoes. KMVCD prefers to use Bti because of the low impacts to the environment and non-target organisms and its effectiveness in reducing the numbers of target pests. KMVCD proposes to use the formulated Bti product Teknar HP-D at rates of 0.5-1.0 pt/acre, and Vectobac 12AS at rates of 0.25-1 pt/acre.

Methoprene is a synthetic insect growth regulator (IGR) that mimics juvenile hormones (Tomlin, 1994). It interferes with the insect's maturation stages preventing the insect from transforming into the adult stage, thereby precluding reproduction. Methoprene is a contact insecticide that does not need to be ingested. It is most effective on early larval instars but does not affect pupae or adult mosquitoes (Extension Toxicology Network, 1996). Treated larvae will pupate, but will not emerge as adults. KMVCD proposes to use the formulated methoprene product Altosid Liquid Larvicide Concentrate at a rate of 0.75-1.0 oz/acre.

During the early stages of larval growth, typically stages 2-4, Bti is most effective as larvae at these stages of life tends to feed on bacteria and consequently, Bti, that effectively chokes them to death. Altosid is used at later stages of larval growth when feeding ceases. Altosid is absorbed into the bodies of larvae, inhibiting their growth into adults. When larvae of various stages are encountered in large numbers, Bti and Altosid are used to form Duplex which is applied adhering to the same application rates stated above.

Treatment has been conducted mainly by aerial application in areas where monitoring has documented high mosquito larval densities or high concentrations of a specific vector bearing

mosquito species. Aerial application has been done using fixed-wing aircraft flown at an altitude of 10-20 feet above the vegetation and at airspeeds of 130-140 miles per hour. Treatment duration would average 20 minutes, but would vary given the size of the treatment area. Aerial pass distance would vary depending on the treatment area, but would average 70 feet. The pilot would use a map of units to be treated as well as utilizing a GPS system as an additional guide.

Applications of larvicides may occur anywhere in the wetland and moist soil units of the Refuge. The potential wetland areas for mosquito breeding and consequently mosquito treatment is 7,900 acres. Most the Refuge's moist soil and winter wetland areas are devoid of water during the summer months. Fall flooding for migrating and wintering waterfowl habitat begins in August. Spring draining starts in March. Mosquito control applications can occur anytime between April through November, depending on environmental conditions, but normally occur during August, September, and October when water is being added to the wetland units. In the last five years, mosquito control treatments have occurred from August through October, except for once in June (6/15/99), once in July (7/23/02), and twice in November (11/2/99 and 11/1/01).

Annual precipitation amounts have a direct effect on mosquito populations. During drought years (seasons having low precipitation) mosquito populations tend to be low, and during wet years (seasons with high precipitation) mosquito populations tend to be high. Mosquito control is consequently conducted as a response to seasonality and/or climatic cycles.

The total area of the Refuge that is treated varies with the conditions of each year. The range in area treated in the last five years varied from a low of 1677 acres in 2003 to a high of 2468 acres in 2002. Some of these areas are treated more than once, resulting in the total acres treated ranging from 2525 acres sprayed in 1999 to 4570 acres sprayed in 2002. The average number of applications to units that were treated was about two, but applications may occur up to 4 times during the year at a specific site. Between 1988 and 2000, 5 to 10 treatments occurred per season. More recently the number of treatments required has risen to 13 in 2001, 19 in 2002, and 16 in 2003. The average area covered per treatment is 263 acres (124 acres standard deviation), but coverage has varied from 30 to 610 acres.

KMVCD has been controlling mosquito populations with larvicides on the Refuge for over 20 years. During the last 5 of those years KMVCD has accomplished mosquito control through the use of fixed-wing aircraft as well as ground application methods. .

Mosquito control with adulticides

If efforts to control immature mosquitoes fail to prevent adult trap counts from exceeding 150 per night, and WNV and/or WEE or SLE are detected within or near the Refuge, KMVCD proposes to treat infested areas with a mosquito adulticide. KMVCD proposes to use the adulticides Pyrocide or Pyrenone, which have natural pyrethrins as the active ingredient.

Pyrethrins are naturally occurring compounds produced by certain species of chrysanthemum flowers. The flowers of the plant are harvested shortly after blooming and are either dried and powdered, or oils within the flowers are extracted by solvents.

Pyrethrins are non-systemic contact poisons which quickly penetrate the nerve system of the insect and cause paralysis and subsequent death (EXTOXNET 1994, Tomlin 1994). A few minutes after application, the insect cannot move or fly away. But, a "knockdown dose" does not mean a

killing dose. Pyrethrins are swiftly detoxified by enzymes in the insect. Thus, some pests will recover. To delay the enzyme action so a lethal dose is assured, commercial products are formulated with synergists such as piperonyl butoxide, which inhibit detoxification (Tomlin, 1994). Both products KMVCD proposes, Pyrocide and Pyrenone, are composed of 5% pyrethrins and 25% piperonyl butoxide, They are applied as an ultra-low volume (ULV) fog at a rate of 0.1 fluid oz/ac (0.0025 lbs ai/ac pyrethrin) by air and/or ground.

Availability of Resources: Monitoring and control will not require refuge personnel. The KMVCD and U.C. Davis arbovirus field station are responsible for coordination of monitoring and control through the Refuge Manager or the Assistant Refuge Manager. In order to monitor treatment of wetland, moist soil, and riparian areas, it is estimated that 5% of a full-time employee's time would be required. Monitoring of treatments would include observations of sprayed areas before and after treatment and coordination of permitting, documentation, and record keeping.. Additional funding would be required if a detailed, long-term study were to be conducted to determine effects of mosquito treatment on Refuge resources.

Up to the present we have not been required by Kern County to pay for mosquito control, and we have sufficient funds to cover our obligations. If costs of monitoring and control increase significantly in the future the County may ask for reimbursement.

Anticipated Impacts of the Use: The impacts of monitoring will be confined to pathways to shorelines where dip net samples will be taken. Small areas of vegetation may be crushed in transit to pools of water, but the vegetation will likely spring back after it has been bent under foot. There will be relatively little of this impact, as dipping is done at most once a week. Placing and checking of CO2 traps might also create a transient impact from footsteps on the vegetation going to and from the traps. Again, this is done at most once a week. There will be no disturbance of habitat associated with the single light trap, as it is in the maintenance yard at headquarters
.

Toxicity and Effects to Non-target Organisms

The dominant impact of mosquito control will relate to the toxicity and effects of the treatments on non-target organisms. The possible effects of the larvicides Bti and methoprene and the pyrethroid adulticides will be discussed separately.

Bacillus thuringiensis var. *israelensis* (Bti)

Bti has practically no acute or chronic toxicity to mammals, birds, fish, or vascular plants (U.S. U.S. EPA, 1998). Extensive acute toxicity studies indicated that Bti is virtually innocuous to mammals (Siegel and Shadduck, 1992). These studies exposed a variety of mammalian species to Bti at moderate to high doses and no pathological symptoms, disease, or mortality were observed. Laboratory acute toxicity studies indicated that the active ingredient of Bti formulated products is not acutely toxic to fish, amphibians or crustacaceans (Brown et al. 2002, Brown et al. 2000, Garcia et al. 1980, Lee and Scott 1989, and Wipfli et al. 1994). However, other ingredients in formulated Bti products are potentially toxic. The acute toxicity response of fish exposed to the formulated Bti product Teknar® HPD was attributed to xylene (Fortin et al. 1986, Wipfli et al. 1994). Field studies indicated no acute toxicity to several fish species exposed to Bti (Merritt et al. 1989, Jackson et al. 2002); no detectable adverse effects to breeding red-winged blackbirds using and nesting in Bti treated areas (Niemi et al. 1999, Hanowski 1997); and no detectable adverse effects to tadpole shrimp 48 hours post Bti treatment (Dritz et al. 2001).

In addition to mosquitoes (Family Culicidae), Bti affects some other members of the suborder Nematocera within the order Diptera. Also affected are members of the Family Simuliidae (black flies) and some chironomids midge larvae (Boisvert and Boisvert 2000, Garcia et al. 1980). The most commonly observed Bti effects to non-target organisms were to larvae of some chironomids in laboratory settings when exposed to relatively high doses (Boisvert and Boisvert 2000, Lacey and Mulla 1990, Miura et al. 1980). In field studies, effects to target and susceptible nontarget invertebrates have been variable and difficult to interpret. Field study results are apparently dependent on the number, frequency, rate and aerial extent of Bti applications; the Bti formulation used; the sample type (e.g. benthic, water column or drift); the sampling interval (e.g. from 48 hrs to one or more years after treatment); the habitat type (e.g. lentic or lotic); the biotic (e.g. aquatic communities), and abiotic factors (e.g. suspended organic matter or other suspended substrates, temperature, water depth); the mode of feeding (e.g. filter feeder, predator, scraper or gatherer); the larval development stage and larval density (Ali, 1981, Boisvert and Boisvert 2000, Lacey and Mulla,1990). Bti activity against target and susceptible nontarget invertebrates is also related to Bti persistence and environmental fate which are in turn affected by the factors associated with field study results (Dupont and Boisvert 1986, Mulla 1992). Simulated field studies resulted in the suppression of two unicellular algae species, *Closterium* sp. and *Chlorella* sp. resulting in secondary effects to turbidity and dissolved oxygen of aquatic habitats, with potential trophic effects (Su and Mulla, 1999). For these reasons, Bti effects to target and susceptible nontarget organisms, and potential indirect trophic impacts in the field are difficult to predict.

Methoprene

Methoprene has moderate acute fish toxicity, slight acute avian toxicity, and practically no acute mammalian toxicity (U.S. EPA 2000, and U.S. Fish and Wildlife Service 1984). In mallard ducks, dietary concentrations of 30 parts per million (ppm) caused some reproductive impairment (U.S. EPA 1991). This figure exceeds the estimated environmental concentration by a factor 10 (Table 1). Methoprene residues have been observed to bioconcentrate in fish and crayfish by factors of 457 and 75, respectively (U.S. EPA 1991). Up to 95 % of the residue in fish was excreted within 14 days (U.S. EPA 1991). Risk quotients for birds, fish and mammals are below EPA levels of concern for endangered species indicating negligible risk to those taxa resulting from direct exposure using maximum labeled rates for mosquito control (Table 1) (Urban et al. 1986). In field studies no detectable adverse effects to breeding red-winged blackbirds using and nesting in areas treated with methoprene were observed (Niemi et al. 1999).

Table 1. Risk assessment for Methoprene.

Animal	Acute Tox (ppm)	EEC (ppm)	RQ	LOC (ES)
Bird	> 4640 (8 D LC 50)	3.0 (short grass)	0.0006	0.1
Fish	0.4 (96 hr LC 50)	0.01 (6 inches)	0.025	0.05
Mammal	> 34,000 (LD 50)	3.0 (short grass)	0.00001	0.1

EEC calculated using a rate of 0.013 lbs ai/ac (1.0 fluid oz/ac Altosid 20 % methoprene)
LD 50 for mammals converted to 1 Day LC50 using a conversion factor of 0.1 for RQ calculation

Methoprene affects terrestrial and aquatic invertebrates and is used to control fleas, sciarid flies in mushroom houses; cigarette beetles and tobacco moths in stored tobacco; Pharaoh's ants; leaf miners in glasshouses; and midges (Tomlin 1994). Methoprene may also be fed to livestock in a premix food supplement for control of hornfly (WHO, undated). Methoprene is highly toxic to aquatic invertebrates with a 48 hour EC50 of 0.89 ppm for *Daphnia magna* (U.S. EPA, 1991).

Laboratory studies show that methoprene is acutely toxic to chironomids, cladocerans, and some decapods, (Horst and Walker 1999, Celestial and McKenney 1994, McKenney and Celestial 1996, Chu et al. 1997). In field studies, significant declines of aquatic invertebrate, mollusk and crustacean populations have been directly correlated to methoprene treatments for mosquito control (Breaud et al. 1977, Miura and Takahashi 1973, Niemi et al. 1999, and Hershey et al., 1998).

Methoprene has a ten day half life in soil, a photolysis half life of ten hours, and solubility in water is 2 ppm (Zoecon 2000). Degradation in aqueous systems is caused by microbial activity and photolysis (U.S. EPA 1991). Degradation rates are roughly equal in freshwater and saltwater systems and are positively correlated to temperature (U.S. EPA 1991).

Pyrethroids

There are only two general classes of adulticides, organophosphates and pyrethroids. The pyrethroids include both natural products called pyrethrins and synthetic molecules that mimic the natural pyrethrins, such as permethrin, resmethrin, and sumithrin.

In general, pyrethroids have lower toxicity to terrestrial vertebrates than organophosphates. Although not toxic to birds and mammals, pyrethroids are very toxic to fish and aquatic invertebrates (Anderson 1989, Siegfried 1993, Milam et al. 2000). The actual toxicity of pyrethroids in aquatic habitats, however, is less than may be anticipated because of the propensity of these pesticides to adsorb organic particles in water (Hill et al. 1994). KMVCD proposes to use only natural pyrethrins.

Threatened and Endangered Species:

The Refuge is habitat for four endangered species: blunt-nosed leopard lizard (*Gambelia sila*), Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*), Buena Vista Lake ornate shrew (*Sorex ornatus relictus*), and San Joaquin kit fox (*Vulpes macrotis mutica*). Three of these endangered species, the leopard lizard, kangaroo rat, and kit fox, use upland habitats that are concentrated on the west side of the Refuge and out of the potential spray zone. However, transient individuals could occur on levees on the east side of the refuge that is within the potential spray zone. The preferred habitat for the Buena Vista Lake ornate shrew is within the riparian areas of the Refuge which has, in the past, been subject to slight drift from aerial treatment flights. In an extensive literature review on the effects of Bti on mammals, Siegel and Shadduck (1992) found the bacterium to be innocuous. These studies exposed a variety of mammalian species to Bti at moderate to high doses and observed no pathological symptoms, nor disease, or mortality. Continued use of the bacterium, Bti, at moderate rates is likely to have a negligible effect on threatened and endangered species residing on the Refuge.

Fish

Screens across the water intake for the Refuge prevent any large fish from entering the refuge. However, very small individuals of carp, catfish, and bullheads may move through the screens. All these fish die when the ponds are drawn done in early spring. The water released from the refuge goes directly to irrigation either on the Refuge or adjacent lands; it does not return to any streams or lakes. Thus, the toxicity of any of these pesticides to fish populations would not be an issue,

since fish rarely occur on the Refuge, could not survive the draw-down in spring, and cannot move from the refuge to any other bodies of water.

Wetlands and Waterfowl:

The Refuge was established to provide habitat for migratory birds, in particular waterfowl which includes geese, swans, ducks, and coots. These species occur on the refuge during August, September, and October when newly flooded wetlands are being treated to control mosquitoes, so there is a potential impact on them.

There is not likely to be much impact on geese and swans are year round herbivores. Geese feed mainly on grasses and agricultural lands, while swans feed mainly on roots, tubers, stems, and leaves of submerged and emergent aquatic vegetation. While applications of Bti and Altosid would be likely to occur over areas of vegetation which may be used by geese and swans, it has been found that birds are not negatively affected by utilizing foods exposed to Bti or methoprene (Niemi et al. 1999).

In contrast, ducks are known to be opportunistic feeders on both plants and invertebrates, utilizing the most readily available food sources. Invertebrates, plants, and seeds compose the majority of their diet, varying with the season and the geographic location. A study in California's Sacramento Valley has shown that plant foods are dominant in fall diets of northern pintails, while invertebrate use increases in February and March (Miller 1987). Seeds of swamp timothy comprise the most important duck food in the summer-dry habitats of the San Joaquin Valley (Miller 1987). At the Kern National Wildlife Refuge, the fall diet of northern pintails and green-winged teal was composed of over two-thirds seeds (Euliss and Harris 1987). Thus any food chain impacts resulting from larvicide and adulticide treatment will have limited impacts to the mainly seed diet of newly arriving ducks. Their diet shifts to invertebrates after mosquito treatments are expected to be reduced in frequency, thereby allowing the invertebrate populations to recover.

Recent studies have shown that aquatic invertebrates are a dominant food of non-breeding waterfowl during the summer molt, and the fall and winter periods (Heitmeyer 1988). Invertebrates are also critical for egg production during the spring (Swanson et al. 1979), and duckling growth during the summer rearing period (Krapu and Swanson 1978). Mosquitoes and chironomids make an important contribution to invertebrate food resources throughout the year. Other significant food resource contributors of the invertebrate community are Coleoptera, Odonata, and Trichoptera.

However, during fall flood-up and peak mosquito populations, ducks tend to feed on seed and other plant material. Waterfowl in general tend to feed on seeds when they reach their wintering areas, perhaps to regain energy lost during long flights (Heitmeyer 1988, Miller 1987). Thus any food chain impacts resulting from larvicide and adulticide treatment will have limited impacts to the mainly seed diet of newly arriving ducks. Their diets shift to invertebrates after treatments are expected to be reduced in frequency thereby allowing invertebrate populations to recover.

Other Migratory Birds:

Shorebirds feed on a wide variety of invertebrates all year, feeding which intensifies at the onset of spring migration. Documentation of indirect food-chain effects have not come to light. Hanowski et al. (1997) studied 19 different bird species after collecting data on wetlands 2 years

before treatment and 3 years after treatment of both Bti and methoprene applications and found no negative effects. Niemi et al. found the same results from the same study site of a 3 year study on zooplankton or breeding birds.

There are primarily two California State Species of Concern which forage and nest on the Refuge, they are tri-colored blackbirds, and white-faced ibis. Both species are associated with wetland habitat that has been identified, through monitoring by KMVCD, to contain mosquitos targeted for control. While resident endangered species are limited to upland habitat on the Refuge, these sensitive species prefer wetland habitat or habitat bordering wetlands. While Hanowski et al. (1997) found no direct evidence to indicate Bti or methoprene negatively impacted the reproduction, growth, or foraging of red-winged blackbirds, to minimize impacts to these species, in particular, during their breeding season, no applications will occur where tri-colored blackbirds or white-faced ibis are nesting.

Public Review and Comment: If, through monitoring it is determined that targeted mosquito species that: 1) are known carriers of Encephalitis, and 2) that they occur in densities that warrant control, the public will be notified. However, given the nature of potential serious health risks and the rapid development of mosquito larvae, applications may occur simultaneously with public notification or before. As part of the Comprehensive Conservation Plan process, a public review and comment period will be conducted during which time the current mosquito management guidelines will be reviewed by the public.

Determination (Check one Below)

_____ Use is not compatible _____X____ Use is compatible

Stipulations Necessary to Ensure Compatibility:

1. All application of pesticides/biological agents must be coordinated and approved by the Refuge Manger or Assistant Refuge Manager to avoid conflicts with nesting birds, public use, Refuge management activities, etc. **Refuge staff will be present during all ground and aerial applications**. Prior to all applications, KMVCD will provide a map and dip net counts to the Refuge Manager or Assistant Manger and obtain verbal approval. If Refuge Manager or Assistant Manager is not in the office, leave map and counts with clerk and call for approval later. In addition to verbal permission, the permittee or designated representative form the Bakersfield office will call and confirm flight and conditions.

2. A threshold level of 1 larva per dip average will be instituted for mosquito control.

3. Screens will be placed on and around the bottom of the chicken coop to exclude other wildlife.

4. The KMVCD will notify the Refuge Manager immediately if chickens die, disappear, or if blood samples exhibit disease conversion. All dead birds will be sent to the USFWS National Wildlife Health Center (NWHC) in Madison, WI., if requested by the Refuge Manager.

5. KMVCD will provide the Refuge with interim and final reports regarding the arbovirus

studies on the Refuge and in Kern County, including data on dip netting and CO2 and light traps. KMVCD will also provide these reports to the NWHC. Maintaining careful records of immature mosquito occurrence, developmental stages treated, source size, and control effectiveness can provide an early warning to forecast the size of the adult population.

6. KMVCD will notify the Refuge Manager immediately if an arborvirus-induced mortality is observed in wild birds in Kern County.

7. Spray applications will occur only on designated refuge lands east of Goose Lake Canal and within Unit 9 and 14 west of this canal. Spraying will not be conducted on ephemeral pools or other such water basins resulting from rainwater accumulations in upland sites.

8. KMVCD has and will continue to consider environmental conditions, including water temperature, density of mosquito larvae, and presence of mosquito predators, when deciding mosquitoes on the Refuge pose a serious threat to human health and whether to treat.

9. Mosquito adulticides will only be allowed in cases of a human health emergency, following a specific request to the Refuge and written concurrence from appropriate Service or Department bureaus. A human-health emergency is defined by the presence of human disease virus-positive mosquitoes or virus-positive birds in Kern County or adjacent counties. Treatment may be allowed only when entomological surveys determine the presence of mosquitoes on Refuge pose a human health emergency.

10. At the end of the permitting period, KMVCD will provide the Refuge Manager with a list of all pesticides/biological agents used, and the quantities of each that were applied.

11. Access will be prohibited in closed areas on Wednesdays and Saturdays during the waterfowl hunt season.

12. Application of mosquito control measures is to be conducted in accordance with approved Pesticide Use Proposals.

13. Mosquito control will be authorized on an annual basis by a Special Use Permit (SUP). SUP condition will stipulate that all mosquito control work will be carried out under the guidance of pre-approved Pesticide Use Proposals.

Justification:

For many years the Refuge has worked cooperatively with KMVCD and its associated mosquito control activities. After a review of these activities, the Refuge has determined that allowing these uses to continue would not interfere or derogate from the purpose for the Refuge, nor the mission of the National Wildlife Refuge System.

As previously mentioned, the Refuge has, within a 20 mile radius, communities of various populations surrounding it. Species of mosquito like *Culex tarsalis*, *Aedes vexans, Ochlerotatus melanimon*, and *O. nigromaculis,* which are found on the Refuge, are capable of dispersing various miles to obtain a blood meal. With the exception of *Culex tarsalis*, the remaining fore mentioned species are capable of dispersing 5-10 miles; *Culex tarsalis* is known to disperse 25+

miles. All species are known to be vectors for Saint Louis encephalitis, California encephalitis, and western equine encephalitis; additionally, *C. tarsalis* is particularly known to transmit West Nile virus. In 1989 and 1990, sentinel chickens tested positive for Saint Louis encephalitis and in 1996, 1997, and 1998 (Kern Refuge files), tested positive for western equine encephalitis. Additionally, mosquitoes sampled during 1989 and 1998 tested positive for Saint Louis and western equine encephalitis respectively. Reisen et. al. (1992) found that the significant 1989 outbreak of Saint Louis encephalitis in the Southern San Joaquin Valley was tied directly to especially large numbers of *C. tarsalis*. Some factors which led to a greater than normal numbers of *C. tarsalis* in this area in 1989 were an unseasonably mild spring which allowed the species to successfully over winter, further amplifying their numbers when warmer weather set in. This same study also indicated that many of the overwintering population were found on the Refuge. In order to protect neighboring communities from potential health threats from vector carrying mosquitoes, the Refuge will continue to allow mosquito control to take place on Refuge following the guidance of the stipulations within this document. In the event that a human health emergency has been declared, perhaps as a consequence of West Nile virus, the use of adulticides may be permitted with the concurrence of the refuge manager..

Because mosquito treatment occurs during the early weeks of fall flood-up, and frequency of treatments are low and spaced apart on a per unit basis, overall effects to non-target organisms are not expected to be significant. Treatments will further minimize adverse impacts to wildlife by being conducted during the early morning hours of 0600-0900, flight durations averaging 30 minutes to 2 hours depending on the treatment area. Treated areas are not overlapped and are treated, on average, twice a year during the breeding season. Breeding seasons vary for two targeted mosquito species *Culex tarsalis* and *Ochlerotatus melanimon*, the fore mentioned species breeds in standing water year round while the latter species is primarily a flood water breeder. Treatments for *Culex tarsalis* occurs year round, given the abundance of the species, and tends to be ground application during the summer months while treatments for *Ochlerotatus melanimon* occurs during late summer through late fall when the Refuge begins winter flood up.

While treatment on the ground may seem ideal because the impact area is small and can be accomplished from existing roads and levees, aerial treatment is preferred as the impacts to the ground are non-existent and the amount of coverage is larger, less time consuming, and effective over a large area.

Low flying aircraft will undoubtedly cause disturbances to wildlife. However, the number of treatment days per year is fairly low, and if the applicator (pilot or ground) follows the stipulations previously outlined and within the SUP, mosquito abatement practices should not materially interfere with or detract from the Refuge purpose or the mission of the National Wildlife Refuge System. If additional biological monitoring of this activity documents substantial negative impacts to migratory birds or other wildlife, this determination would be re-analyzed on the basis on new evidence.

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Mandatory Re-Evaluation Date (provide month and year):

_____ Mandatory 15-year Re-Evaluation Date (for priority public uses)

___2013_ Mandatory 10-year Re-Evaluation Date (for all uses other than priority public uses)

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

____X__ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

_____ _Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

Refuge Determination:

Prepared by: _____ _____
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: _____ _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____ _____
(Signature) (Date)

Regional Chief,
National Wildlife
Refuge System: _____ _____
(Signature) (Date)

California/Nevada
Operations Manager _____ _____
(Signature) (Date)

Compatibility Determination

Use: Monitor and control mosquitoes

Refuge Name: Pixley National Wildlife Refuge (Established November 17, 1959)

Establishing and Acquisition Authorities: The Pixley National Wildlife Refuge, located in Tulare County, California was established in 1959 under provisions of the Bankhead-Jones Farm Tenant Act (U.S.C. ' 1101), Secretarial Order 2843, and the Endangered / Species Act of 1973 (16 U.S.C. ' 1534).

Refuge Purpose(s): Bankhead-Jones Farm Tenant Act (7 U.S.C. ' 1101) for purposes of a land conservation and land-utilization program.

Secretarial Order 2843, dated November 17, 1959 as a refuge for Migratory birds and other wildlife.

Endangered Species Act of 1973 (16 U.S.C. ' 1534), to conserve fish, wildlife and plants which are listed as endangered or threatened species.

National Wildlife Refuge System Mission: The Mission of the National Wildlife Refuge System is to administer a national network of lands and waters for the conservation, management, and where appropriate, restoration of the fish, wildlife and plant resources and their habitats within the United States for the benefit of present and future generations of Americans.

Description of Use: The Tulare Mosquito Abatement District (TMAD) proposes to continue using Pixley National Wildlife Refuge (Refuge) for monitoring and controlling mosquitoes to address human health concerns of neighboring communities. The Community of Earlimart lies 10 miles south-east of the Refuge, the community of Pixley 6 miles due west, and the community of Alpaugh 8 miles south-west. Within a 20 mile radius of the Refuge are small to large dairies. Residents of Tulare County have voiced concern about biting mosquitoes and mosquito-borne disease. To address these concerns, TMAD has been monitoring and controlling mosquitoes on the Refuge since 1963 when the wetland basins were constructed, in years when ponds of water are present.

While mosquitoes are considered a nuisance because of their biting, many species are known vectors of serious diseases in California. Although 12 mosquito-borne viruses are known to occur in California, only western equine encephalomyelitis virus (WEE) and St. Louis encephalitis virus (SLE) have caused significant outbreaks of human disease (CA Dept. of Health Services, 2003). California is also at risk for West Nile virus (WN) which has been detected in 2003 in adult mosquitoes in Imperial County and crows in Orange County.

WEE tends to be most serious in very young children, whereas elderly people are most at risk to SLE and WN (CA Dept. of Health Services, 2003). WEE and WN can cause serious

diseases in horses and emus, and WN kills a wide variety of endemic and imported birds. Mosquito control is the only known practical method of protecting people and animals from WEE, SLW, and WN (CA Dept. of Health Services, 2003). With the exception of available vaccines to protect horses against WEE and WN, there are no known specific treatments or cures for diseases caused by these viruses (CA Dept. of Health Services, 2003).

The mosquito species identified by TMAD for monitoring and control are *Culex erythrothorax*, *Cx. pipiens*, *Cx. tarsalis*; *Ochlerotatus dorsalis*, *Oc. melanimon*, *Oc. nigromaculis*, and *Aedes vexans*. *Culex tarsalis* is the primary vector of WEE and SLE in California and is also considered to be a significant vector of WN (CA Dept. of Health Services, 2003). *Culex pipiens, Cx. erythrothorax,* and *Oc. melanimon, Oc. dorsalis*, and *Aedes vexans* may also contribute to disease transmission (Goddard, 2002).

Mosquito Monitoring

TMAD monitoring activities are designed to estimate the abundance of immature (larvae and pupae) and adult mosquito populations. TMAD proposes to use the "dipper," method to monitor immature mosquito populations. A dipper is simply a long-handled ladle (ca 500 ml) used to collect water samples from pools potentially serving as mosquito sources. Using the dipper method, the number of immature mosquitoes per "dip" can be estimated. Dip counts are also used to determine the need for mosquito control, and captured immature mosquitoes would be identified taxonomically by skilled technicians.

Only a small portion of the Refuge, 950 acres (15% of the total 6389 acres) has been set aside for wetland units (Figure 1), and only 300 acres (Units 2-4, Figure 2) are regularly flooded from mid-August to March for waterfowl habitat. Sampling would be conducted in these areas, and in any standing water in shallow ponds or ditches, such as the Deer Creek channel on the south edge of the Refuge.

During an average year, TMAD would assess mosquito populations between the months of April and November. However, because the wetlands are dry throughout the late spring and summer, sampling usually begins in mid-August with the exception of very wet years when there may be standing water during April, May, or even June. Dip samples will be taken about once a week, depending on presence or absence of water.

TMAD proposes to use carbon dioxide (CO2) baited traps to monitor adult mosquito populations. There are two types of CO2-baited traps used in California, the CDC trap and the EVS trap. Both traps are baited either with an insulated container holding 1-2 kg of dry ice or with a cylinder containing compressed CO2 gas with a regulator that releases 0.5 - 1.0 liters/minute. Both traps use a screened collection bag or a modified gallon ice cream carton with tubular surgical stockinet attached to the bottom of the motor housing unit to retain the collected mosquitoes. The CDC trap uses a rechargeable 6v battery power source whereas the EVS trap uses three 1.5v D cell batteries. The CO2 trap nearest Pixley Refuge is at a private residence one block south of Allensworth State Historic Park, about 2.5 miles to the south. Adults are sampled weekly from April through November and individuals collected would be identified taxonomically by skilled technicians and, could also be tested for WEE, SLE, and WN.

The monitoring activities described above are conducted under a Special Use Permit (SUP) between the Refuge and TMAD. The Refuge proposes to allow the TMAD to continue these activities under an annual SUP.

Mosquito Control with Larvicides

The TMAD proposes to control mosquitoes by treating areas infested with larval states of *Culex erythrothorax, Cx. pipiens, Cx. tarsalis; Ochlerotatus dorsalis, Oc. melanimon, Oc. nigromaculis,* and *Aedes vexans*. Mosquito control would be initiated with the use of larvicides when an average of two or more larvae is captured per dip. TMAD proposes to treat larval mosquitoes using *Bacillus thuringiensis* serovar *israelensis* (Bti) and methoprene, which will be applied in multiple treatments using aerial and ground application methods.

Bti is a microbial insect pathogen used to control larval stages of mosquitoes and black flies. It is a naturally occurring anaerobic spore forming bacteria that is mass produced using modern fermentation technology. Bti produces protein endotoxins that are activated in the alkaline mid-gut of insect species and subsequently bind to protein specific receptors of susceptible insect species resulting in the lethal response (Lacey and Mulla 1990). Bti must therefore be ingested by the target insect to be effective. It is most effective on younger mosquito larval instars but does not affect pupae or adult mosquitoes. TMAD prefers to use Bti because of the low impacts to the environment and non-target organisms and its effectiveness in reducing the numbers of target pests. TMAD proposes to use the formulated Bti product Teknar HP-D at rates of 0.5-1.0 pt/acre.

Methoprene is a synthetic insect growth regulator (IGR) that mimics juvenile hormones (Tomlin, 1994). It interferes with the insect's maturation stages preventing the insect from transforming into the adult stage, thereby precluding reproduction. Methoprene is a contact insecticide that does not need to be ingested. It is most effective on early larval instars but does not affect pupae or adult mosquitoes (Extension Toxicology Network, 1996). Treated larvae will pupate, but will not emerge as adults. TMAD proposes to use the formulated methoprene product Altosid Liquid Larvicide Concentrate at a rate of 0.75-1.0 oz/acre.

Bti is most effective during the early stages of larval growth, typically stages 2-4. Larvae at these stages of life tend to feed on bacteria, and consequently, Bti, which effectively chokes them to death. Altosid is used at later stages of larval growth when feeding ceases. Altosid is absorbed into the bodies of larvae, inhibiting their growth into adults.

Annual precipitation amounts have a direct effect on mosquito populations. During drought years (seasons having low precipitation) mosquito populations tend to be low, and during wet years (seasons with high precipitation) mosquito populations tend to be high. Mosquito control is consequently conducted as a response to seasonality and/or climatic cycles.

Treatment will be conducted mainly by aerial application in areas where monitoring has documented high mosquito larval densities or high concentrations of a specific vector bearing mosquito species. Aerial application has been done using fixed-wing aircraft flown at an altitude of 10-20 feet above the vegetation and at airspeeds of 130-140 miles per hour.

Treatment duration would average 20 minutes, but would vary given the size of the treatment area. Aerial pass distance would vary depending on the treatment area, but would average 70 feet. The pilot would use a map of units to be treated as well as utilizing a GPS system as an additional guide.

Applications of larvicides may occur anywhere in the wetland and moist soil units of the Refuge. The potential wetland areas for mosquito breeding and consequently mosquito treatment are 450 acres. Most the Refuge's moist soil and winter wetland areas are devoid of water during the summer months. Fall flooding for migrating and wintering waterfowl habitat begins in August. Spring draining starts in March. Mosquito control applications can occur anytime from April through November, depending on environmental conditions, but normally occur during from mid-August through October, when water is being added to the wetland units.

TMAD proposes to apply larvicides when the threshold of an average of two larvae per dip is exceeded. Mosquito treatments on the Refuge have been rare; there have been no treatments since 1995.

Mosquito Control with Adulticides

If efforts to control immature mosquitoes fail to prevent adult trap counts from exceeding 150 per night, and WN, WEE, or SLE are detected within or near the Refuge, and a public health emergency is declared by the state or county, TMAD proposes to treat infested areas with a mosquito adulticide.

There are only two general classes of adulticides, organophosphates and pyrethroids. The organophosphates proposed for use is naled. The pyrethroids include both natural products called pyrethrins and synthetic molecules that mimic the natural pyrethrins, such as permethrin, resmethrin, and sumithrin.

TMAD proposes to use the adulticide naled to control adult mosquitoes. Naled is a non-systemic, broad spectrum organophosphate insecticide and acaricide (kills mites and ticks), with contact and stomach action, respiratory action, and cholinesterase inhibition. TMAD proposes to use the formulated naled product Trumpet EC at a rate of 0.24 fluid oz/acre by ground and/or 0.6-1.2 fluid oz/acre by air.

The Refuge suggests that TMAD uses Pyrocide or Pyrenone, in which the active ingredient, pyrethrins, are non-systemic contact poisons which quickly penetrate the nerve system of the insect, causing paralysis and subsequent death (EXTOXNET 1994, Tomlin 1994). Pyrethrins are naturally occurring compounds produced by certain species of chrysanthemum plants. The flowers of the plant are harvested shortly after blooming and are dried and powdered, or oils within the flowers are extracted by solvents. These active insecticidal components are collectively known as pyrethrins. Two pyrethrins are most prominent, pyrethrin-I and pyrethrin-II. The pyrethrins have another four different active ingredients, Cinerin I and II and Jasmolin I and II (EXTOXNET, 1994).

A few minutes after application, the insect cannot move or fly away. But, a "knockdown dose" does not mean a killing dose. Pyrethrins are swiftly detoxified by enzymes in the insect. Thus, some pests will recover. To delay the enzyme action so a lethal dose is

assured, commercial products are formulated with synergists such as pepperoni butoxide, which inhibit detoxification (Tomlin, 1994). Both products TMAD proposes to use are composed of 5% pyrethrins and 25% piperonyl butoxide. They are applied as an ultra-low volume (ULV) fog at a rate of 0.0025 lbs/acre for pyrethrin and 0.0125 lbs/acre piperonyl butoxide.

The Refuge suggests the use of pyrethrins rather than naled because lower overall toxicity. Among other characteristics, pyrethroids are in a lower skin and eye toxicity class (class IV) than is naled (class I). In addition, naled is a class II toxic chemical, while pyrethroids, although not EPA listed, can be considered a class III toxicity class, on the basis of LD50 data (New York State Department of Health on the web).

TMAD proposes to apply adulticides using ground and/or aerial equipment consisting of an ultra-low volume (ULV) non-thermal aerosol device mounted on a truck or fixed wing aircraft. Adulticide application may occur only after a human health emergency has been declared by the state or county. Adulticides have never been sprayed on Pixley Refuge.

Availability of Resources: Monitoring and control will not require Refuge personnel. The TMAD is responsible for coordination of monitoring and control through the Refuge Manager. In order to monitor treatment of wetland, moist soil, and riparian areas, it is estimated that 5% of a full-time employee's time would be required. Monitoring of treatments would include observations of sprayed areas before and after treatment and coordination of permitting, documentation, and record keeping with TMAD.

If larvae are detected at sufficient density to create a problem, TMAD proposes to treat the area where the larvae are found on two occasions. Any control necessary beyond these initial treatments would need to be funded by another source. Additional funding would also be required if detailed long-term studies were to be conducted to determine effects of mosquito treatment on Refuge resources.

Anticipated Impacts of the Use

The impacts of monitoring will be confined to pathways and shorelines where dip net samples will be taken. Small areas of vegetation may be crushed in transit to the shoreline, but the vegetation will likely spring back after it has been bent under foot. There will be relatively little of this impact, as dipping is done at most once a week.

Toxicity and Effects to Non-target Organisms

The dominant impact of mosquito control will relate to the toxicity and effects of the treatments on non-target organisms. The possible effects of the larvicides Bti and methoprene and the pyrethroid adulticides will be discussed separately.

Bacillus thuringiensis var. *israelensis* (Bti)

Bti has practically no acute or chronic toxicity to mammals, birds, fish, or vascular plants (U.S. EPA, 1998). Extensive acute toxicity studies indicated that Bti is virtually innocuous to mammals (Siegel and Shadduck, 1992). These studies exposed a variety of mammalian species to Bti at moderate to high doses and no pathological symptoms, disease, or mortality were observed. Laboratory acute toxicity studies indicated that the active ingredient of Bti formulated products is not acutely toxic to fish, amphibians or

crustaceans (Brown et al. 2002, Brown et al. 2000, Garcia et al. 1980, Lee and Scott 1989, Wipfli et al. 1994). However, other ingredients in formulated Bti products are potentially toxic. The acute toxicity response of fish exposed to the formulated Bti product Teknar® HPD was attributed to xylene (Fortin et al. 1986, Wipfli et al. 1994). Field studies indicated no acute toxicity to several fish species exposed to Bti (Merritt et al. 1989, Jackson et al. 2002); no detectable adverse effects to breeding red-winged blackbirds using and nesting in Bti treated areas (Niemi et al. 1999, Hanowski et al.1997); and no detectable adverse effects to tadpole shrimp 48 hours post Bti treatment (Dritz et al. 2001).

In addition to mosquitoes (Family Culicidae), Bti affects some other members of the suborder Nematocera within the order Diptera. Also affected are members of the Family Simuliidae (black flies) and some chironomid midge larvae (Boisvert and Boisvert 2000, Garcia et al. 1980). The most commonly observed Bti effects to non-target organisms were to larvae of some chironomids in laboratory settings when exposed to relatively high doses (Boisvert and Boisvert 2000, Lacey and Mulla 1990, Miura et al. 1980). In field studies, effects to target and susceptible nontarget invertebrates have been variable and difficult to interpret. Field study results are apparently dependent on the number, frequency, rate and aerial extent of Bti applications; the Bti formulation used; the sample type (e.g. benthic, water column or drift); the sampling interval (e.g. from 48 hrs to one or more years after treatment); the habitat type (e.g. lentic or lotic); the biotic (e.g. aquatic communities), and abiotic factors (e.g. suspended organic matter or other suspended substrates, temperature, water depth); the mode of feeding (e.g. filter feeder, predator, scraper or gatherer); the larval development stage and larval density (Ali 1981, Boisvert and Boisvert 2000, Lacey and Mulla 1990). Bti activity against target and susceptible nontarget invertebrates is also related to Bti persistence and environmental fate which are in turn affected by the factors associated with field study results (Dupont and Boisvert 1986, Mulla 1992). Simulated field studies resulted in the suppression of two unicellular algae species, *Closterium* sp. and *Chlorella* sp. resulting in secondary effects to turbidity and dissolved oxygen of aquatic habitats, with potential trophic effects (Su and Mulla 1999). For these reasons, Bti effects to target and susceptible nontarget organisms, and potential indirect trophic impacts in the field are difficult to predict.

Methoprene

Methoprene has moderate acute fish toxicity, slight acute avian toxicity, and practically no acute mammalian toxicity (U.S. EPA 2000, U.S. Fish and Wildlife Service 1984). In mallard ducks, dietary concentrations of 30 parts per million (ppm) caused some reproductive impairment (U.S. EPA 1991). This figure exceeds the estimated environmental concentration by a factor 10 (Table 1). Methoprene residues have been observed to bioconcentrate in fish and crayfish by factors of 457 and 75, respectively (U.S. EPA 1991). Up to 95 % of the residue in fish was excreted within 14 days (U.S. EPA 1991). Risk quotients for birds, fish and mammals are below EPA levels of concern for endangered species indicating negligible risk to those taxa resulting from direct exposure using maximum labeled rates for mosquito control (Table 1) (Urban et al. 1986). In field studies no detectable adverse effects to breeding red-winged blackbirds using and nesting in areas treated with methoprene were observed (Niemi et al. 1999).

Table 1. Risk assessment for Methoprene.

Animal	Acute Tox (ppm)	EEC (ppm)	RQ	LOC (ES)
Bird	> 4640 (8 D LC 50)	3.0 (short grass)	0.0006	0.1
Fish	0.4 (96 hr LC 50)	0.01 (6 inches)	0.025	0.05
Mammal	> 34,000 (LD 50)	3.0 (short grass)	0.00001	0.1

EEC calculated using a rate of 0.013 lbs ai/ac (1.0 fluid oz/ac Altosid 20 % methoprene)
LD 50 for mammals converted to 1 Day LC50 using a conversion factor of 0.1 for RQ calculation

Methoprene affects terrestrial and aquatic invertebrates and is used to control fleas, sciarid flies in mushroom houses; cigarette beetles and tobacco moths in stored tobacco; Pharaoh's ants; leaf miners in glasshouses; and midges (Tomlin 1994). Methoprene may also be fed to livestock in a premix food supplement for control of hornfly (WHO, undated). Methoprene is highly toxic to aquatic invertebrates with a 48 hour EC50 of 0.89 ppm for *Daphnia magna* (U.S. EPA 1991). Laboratory studies show that methoprene is acutely toxic to chironomids, cladocerans, and some decapods (Horst and Walker 1999, Celestial and McKenney 1994, McKenney and Celestial 1996, Chu et al. 1997). In field studies, significant declines of aquatic invertebrate, mollusk and crustacean populations have been directly correlated to methoprene treatments for mosquito control (Breaud et al. 1977, Miura and Takahashi 1973, Niemi et al. 1999, Hershey et al. 1998).

Methoprene has a ten day half life in soil, a photolysis half life of ten hours, and solubility in water is 2 ppm (Zoecon 2000). Degradation in aqueous systems is caused by microbial activity and photolysis (U.S. EPA 1991). Degradation rates are roughly equal in freshwater and saltwater systems and are positively correlated to temperature (U.S. EPA 1991).

Naled

The organophosphate naled is toxic to fish, aquatic invertebrates, wildlife, and bees (see label). Naled has high acute mammalian toxicity, slight acute avian toxicity, high acute fish toxicity, and super acute aquatic invertebrate toxicity (U.S. EPA 2000 and U.S. Fish and Wildlife Service 1984). The adulticide Trumpet, with the active ingredient naled, that TMAD proposes for possible use in case of a public health emergency, has the word "Danger" on the label. The "Danger" label indicates that the chemical is highly toxic. The amount of such chemicals that could kill an average adult person lies somewhere between a taste and a teaspoonful. Naled is also in the highest (most potent) of four categories for irritation to the skin and eyes (New York State Department of Health on the web).

Pyrethroids

In general, pyrethroids have lower toxicity to terrestrial vertebrates than organophosphates. Although not toxic to birds and mammals, pyrethroids are very toxic to fish and aquatic invertebrates (Anderson 1989, Siegfried 1993, Milam et al. 2000). The actual toxicity of pyrethroids in aquatic habitats, however, is less than may be anticipated because of the propensity of these pesticides to adsorb organic particles in water (Hill et al. 1994). The adulticides Pyrocide and Pyrenone, which the Refuge proposes for use in case of a public health emergency, have the word "Caution" on the label. The "Caution" label indicates that it would require more than an ounce and perhaps as much as a pint to

kill the average adult. Pyrethroids are also in the lowest (least potent) of four categories for irritation to the skin and eyes (New York State Department of Health on the web).

Threatened and Endangered Species:
The Refuge is habitat for four endangered species: blunt-nosed leopard lizard (*Gambelia sila*), Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*), San Joaquin kit fox (*Vulpes macrotis mutica*). These species use upland habitats that are concentrated on the east and north sides of wetlands on the Refuge and out of the potential spray zone. However, transient individuals could occur on levees surrounding the wetlands and thus fall within the potential spray zone. In an extensive literature review on the effects of Bti on mammals, Siegel and Shadduck (1992) found the bacterium to be innocuous. These studies exposed a variety of mammalian species to Bti at moderate to high doses and observed no pathological symptoms, nor disease, or mortality. Continued use of the bacterium, Bti, at moderate rates is likely to have a negligible effect on threatened and endangered species residing on the Refuge.

Fish
Screens across the water intake for the Refuge prevent any large fish from entering the Refuge. However, very small individuals of carp, catfish, and bullheads may move through the screens. All these fish die when the ponds are drawn done in early spring. The water released from the Refuge goes directly to irrigation either on the Refuge or adjacent lands; it does not return to any streams or lakes. Thus, the toxicity of any of these pesticides to fish populations would not be an issue, since fish rarely occur on the Refuge, could not survive the draw-down in spring, and cannot move from the Refuge to any other bodies of water.

Wetlands and Waterfowl:
The Refuge was established to provide habitat for migratory birds, in particular waterfowl, including geese, swans, ducks, and coots. These species occur on the Refuge during August, September, and October when newly flooded wetlands are being treated to control mosquitoes, so there is a potential impact on them.

There is not likely to be much impact on geese and swans are year round herbivores. Geese feed mainly on grasses and agricultural lands, while swans feed mainly on roots, tubers, stems, and leaves of submerged and emergent aquatic vegetation. While applications of Bti and Altosid would be likely to occur over areas of vegetation which may be used by geese and swans, it has been found that birds are not negatively affected by utilizing foods exposed to Bti or methoprene (Niemi et al. 1999).

In contrast, ducks are known to be opportunistic feeders on both plants and invertebrates, utilizing the most readily available food sources. Invertebrates, plants, and seeds compose the majority of their diet, varying with the season and the geographic location. Studies in California's Sacramento Valley have shown that plant foods are dominate in fall diets of northern pintails, while invertebrate use increases in February and March (Miller 1987). Seeds of swamp timothy comprise the most important duck food in the summer-dry habitats of the San Joaquin Valley (Miller 1987). At the Kern National Wildlife Refuge, the fall diet of northern pintails and green-winged teal was composed of over two-thirds seeds (Euliss and Harris 1987). Thus any food chain impacts resulting from larvicide and

adulticide treatment will have limited impacts to the mainly seed diet of newly arriving ducks. Their diets shift to invertebrates after treatments are expected to be reduced in frequency thereby allowing invertebrate populations to recover.

Other Migratory Birds:
Shorebirds feed on a wide variety of invertebrates all year, feeding which intensifies at the onset of spring migration. Documentation of indirect food-chain effects have not come to light. Hanowski et al. (1997) studied 19 different bird species after collecting data on wetlands 2 years before treatment and 3 years after treatment of both Bti and methoprene applications and found no negative effects. Niemi et al. found the same results from the same study site of a 3 year study on zooplankton or breeding birds.

When water is available, up to 5,000 sandhill cranes (*Grus canadensis*) are known to roost on the wetlands on the Refuge during the winter. The shallow water of the Refuge gives roosting cranes protection from ground predators such as coyotes. They forage during the day mainly in upland habitats. When available, cultivated grains are a major food item. In addition, they capture invertebrates and small mammals from the surface of the ground or by probing into the ground. The cranes are present from October through March, with peak numbers occurring in December and January. Since most of their foraging is done off the Refuge and their presence overlaps with possible mosquito treatments for only a short time, it is not expected that there will be any effect on the cranes.

Public Review and Comment
If, through monitoring it is determined that targeted mosquito species: (1) are known carriers of encephalitis or West Nile Virus, and (2) that they occur in densities that warrant control, the public will be notified. However, given the nature of potential serious health risks and the rapid development of mosquito larvae, applications may occur simultaneously with or before public notification. As part of the CCP process, a public review and comment period will be conducted during which time the current mosquito management guidelines will be reviewed by the public.

Determination (Check one Below)

_____ Use is not compatible _____X____ Use is compatible

Stipulations Necessary to Ensure Compatibility:

1. Access to Pixley NWR is restricted to levees within sections 21 and 22, via Road 88.

2. All application of pesticides/biological agents must be coordinated and approved by the Refuge Manager or Assistant Manager in order to avoid conflicts with nesting birds, public use, Refuge management activities, etc. Prior to all applications, TMAD will provide a map and dip net counts to the Refuge Manager or Assistant Manager and obtain verbal approval. If Refuge Manager or Assistant Manager is not in the office, leave map and counts with clerk and call for approval later. In addition to verbal permission, the permittee or designated representative from the

TMAD office will call and confirm flight and conditions. Access is limited to weekdays, Monday-Friday, only unless prior approval has been granted by the Refuge Manager for access during the weekend, Saturday and Sunday.

3. A threshold level of 2 larvae per dip average will be instituted for mosquito control. At this dip rate, frequency of application should decrease.

4. Monitoring operations are restricted to dip netting, CO2 traps light traps.

5. TMAD will provide the Refuge with interim and final reports on dipping for larval mosquitoes. Data is to include species and number from each sample. Maintaining careful records of immature mosquito occurrence, developmental stages treated, source size, and control effectiveness can provide and early warning to forecast the size of adult populations.

6. TMAD will notify the Refuge Manager immediately if an arbovirus-induced mortality is observed in wild birds in Tulare County.

7. TMAD has and will continue to consider environmental conditions including water temperature, density of mosquito larvae, and presence of mosquito predators when deciding mosquitoes present pose a serious threat to human health and whether to treat.

8. Treatment for the general control of mosquitoes would be limited to Bti and Altosid.

9. The use of mono-molecular films is to be dissuaded at all expense unless other larvicides utilized fail to control mosquitoes, a human health concern exists, and if the majority of larvae present are species which are vectors of arboviruses transmittable to humans. A determination for the use of mono-molecular films would be made with the Refuge and TMAD along with the appropriate health authorities. Notification would be given to appropriate divisions within the U.S. Fish and Wildlife Service for agreement to treat with larvicides other than Bti and Altosid. Frequent monitoring would be normal operating procedures to avert the use of mono-molecular films. The use of mono-molecular films has not occurred on the Refuge since the 1960's.

10. Mosquito adulticides will only be allowed in cases of a human health emergency, following a specific request to the Refuge and written concurrence from appropriate Service or Department bureaus. A human-health emergency is defined by the presence of human disease virus-positive mosquitoes or virus-positive birds in Tulare County or adjacent counties. Treatment may be allowed only when entomological surveys determine the presence of mosquitoes on Refuge pose a human health emergency.

11. Spray applications will not be conducted on ephemeral (vernal) pools or other such water basins resulting form rainwater accumulations in upland sites.

12. At the end of the permitting period, TMAD will provide the Refuge manager with a list of all pesticides/biological agents used, and the quantities of each that were applied.

13. Application of mosquito control measures is to be conducted in accordance with current approved Pesticide Use Proposals.

14. Mosquito control will be authorized on an annual basis by a Special Use Permit (SUP). SUP condition will stipulate that all mosquito control work will be carried out under the guidance of pre-approved Pesticide Use Proposals.

Justification

For many years the Refuge has worked cooperatively with TMAD and its associated mosquito control activities. After a review of these activities, the Refuge has determined that allowing those uses to continue would not interfere or derogate from the purpose for the Refuge, nor the mission of the National Wildlife Refuge System.

As previously mentioned, the Refuge has, within a 20 mile radius, communities of various populations and a number of commercial dairy operations. Species of mosquito like *Culex tarsalis*, *Aedes vexans, Ochlerotatus melanimon*, and *Oc. nigromaculis,* which are found on the Refuge, are capable of dispersing various miles to obtain a blood meal. With the exception of *Culex tarsalis*, the remaining fore mentioned species are capable of dispersing 5-10 miles, *Culex tarsalis* is known to disperse 25+ miles. All species are known to be vectors for Saint Louis encephalitis, California encephalitis, and western equine encephalitis; additionally, *C. tarsalis* is particularly known to transmit West Nile Virus. Reisen et. al. (1992) found that the significant 1989 outbreak of Saint Louis encephalitis in the Southern San Joaquin Valley was tied directly to especially large numbers of *C. tarsalis*. Some factors which led to a greater than normal numbers of *C. tarsalis* in this area in 1989 were an unseasonably mild spring which allowed the species to successfully over winter, further amplifying their numbers when warmer weather set in. This same study also indicated that many of the overwintering population were found on the Refuge. In order to protect neighboring communities from potential health threats from vector carrying mosquitoes, the Refuge will continue to allow mosquito control to take place on Refuge following the guidance of the stipulations within this document. In a case of a large scale human health emergency, perhaps as a consequence of West Nile Virus, mosquito control would not demand thresholds. In the event that a human health emergency has been declared, perhaps as a consequence of West Nile virus, the use of adulticides may be permitted with the concurrence of the Refuge manager.

Because mosquito treatment occurs during the early weeks of fall flood-up, and frequency of treatments are low and spaced apart on a per unit basis, overall effects to non-target organisms are not expected to be significant. Treatments will further minimize adverse impacts to wildlife by being conducted during the early morning hours of 0600-0900, with flight durations averaging 30 minutes to 2 hours depending on the treatment area. Treated areas are not overlapped and are treated, on average, twice a year during the breeding season. Breeding seasons vary for two targeted mosquito species *Culex tarsalis* and

Ochlerotatus melanimon; the fore mentioned species breeds in standing water year round while the latter species is primarily a flood water breeder. Treatments for *Culex tarsalis* occur year round, given the abundance of the species, while treatments for *Oc. melanimon* occur during late summer through late fall when the Refuge begins winter flood up.

Low flying aircraft will undoubtedly cause disturbances to wildlife. However, the number of treatments per year is fairly low, and if the applicator (pilot or ground) follows the stipulations previously outlined and within the SUP, mosquito abatement practices should not materially interfere with or detract from the Refuge purpose or the mission of the National Wildlife Refuge System. If additional biological monitoring of this activity documents substantial negative impacts to migratory birds or other wildlife, this determination would be re-analyzed on the basis on new evidence.

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Mandatory Re-Evaluation Date (provide month and year):

_____ Mandatory 15-year Re-Evaluation Date (for priority public uses)

___2013_ Mandatory 10-year Re-Evaluation Date (for all uses other than priority public uses)

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

_____ Categorical Exclusion without Environmental Action Statement

_____ Categorical Exclusion and Environmental Action Statement

___X____ Environmental Assessment and Finding of No Significant Impact

_____ Environmental Impact Statement and Record of Decision

Refuge Determination:

Prepared by: _____ _____
(Signature) (Date)

Refuge Manager/
Project Leader
Approval: _____ _____
(Signature) (Date)

Concurrence

Refuge Supervisor: _____ _____
(Signature) (Date)

Regional Chief,
National Wildlife
Refuge System: _____ _____
(Signature) (Date)

California/Nevada
Operations Manager _____ _____
(Signature) (Date)

Appendix E. Species Lists

Species Lists: Kern Refuge

Birds

ORDER ANSERIFORMES (SWANS, GEESE & DUCKS)

ANATIDAE (WATERFOWL FAMILY)
Aix sponsa (wood duck)
Anas acuta (northern pintail)*
Anas americana (American wigeon)*
Anas crecca (green-winged teal)*
Anas cyanoptera (cinnamon teal)*
Anas clypeata (northern shoveler)*
Anas discors (blue-winged teal)*
Anas penelope (Eurasian wigeon)
Anas platyrhynchos (mallard)*
Anas strepera (gadwall)*
Anser albifrons (greater white-fronted goose)
Aythya affinis (lesser scaup)
Aythya americana (redhead)*
Aythya collaris (ring-necked duck)*
Aythya marila (greater scaup)
Aythya valisineria (canvasback)*
Branta bernicla (brant)
Branta canadensis (Canada goose)
Bucephala albeola (bufflehead)
Bucephala clangula (common goldeneye)
Bucephala islandica (barrow's goldeneye)
Chen caerulescens (snow goose)
Chen rossii (Ross' goose)
Cygnus columbianus (tundra swan)
Dendrocygna bicolor (fulvous whistling-duck)
Lophodytes cucullatus (hooded merganser)
Mergus merganser (common merganser)
Mergus serrator (red-breasted merganser)
Oxyura jamaicensis (ruddy duck)*

ORDER APODIFORMES (SWIFTS & HUMMINGBIRDS)

APODIDAE (SWIFT FAMILY)
Chaetura vauxi (Vaux's swift)

TROCHILIDAE (HUMMINGBIRD FAMILY)
Archilochus alexandri (black-chinned hummingbird)
Calypte anna (Anna's hummingbird)*
Calypte costae (Costa's hummingbird)
Selasphorus rufus (rufous hummingbird)

ORDER CAPRIMULGIFORMES (GOATSUCKERS)

CAPRIMULGIDAE (GOATSUCKER FAMILY)
Chordeiles acutipennis (lesser nighthawk)
Phalaenoptilus nuttallii (common poorwill)

ORDER CHARADRIIFORMES (SHOREBIRDS)

CHARADRIIDAE (PLOVER FAMILY)
Charadrius alexandrinus (snowy plover)
Charadrius montanus (mountain plover)
Charadrius semipalmatus (semipalmated plover)
Charadrius vociferus (killdeer)*
Pluvialis squatarola (black-bellied plover)

RECURVIROSTRIDAE (STILT & AVOCET FAMILY)
Himantopus mexicanus (black-necked stilt)*
Recurvirostra americana (American avocet)*

SCOLOPACIDAE (SANDPIPER FAMILY)
Actitis macularia (spotted sandpiper)
Arenaria interpres (ruddy turnstone)
Calidris acuminata (sharp-tailed sandpiper)
Calidris alpina (dunlin)
Calidris bairdii (Baird's sandpiper)
Calidris canutus (red knot)
Calidris himantopus (stilt sandpiper)
Calidris mauri (western sandpiper)
Calidris melanotos (pectoral sandpiper)
Calidris minutilla (least sandpiper)
Calidris pusilla (semipalmated sandpiper)
Catoptrophorus semipalmatus (willet)
Gallinago gallinago (common snipe)
Heteroscelus incanus (wandering tattler)
Limnodromus griseus (short-billed dowitcher)
Limnodromus scolopaceus (long-billed dowitcher)
Limosa fedoa (marbled godwit)

Numenius americanus (long-billed curlew)
Numenius phaeopus (whimbrel)
Phalaropus lobatus (red-necked phalarope)
Phalaropus tricolor (Wilson's phalarope)
Tringa flavipes (lesser yellowlegs)
Tringa melanoleuca (greater yellowlegs)
Tringa solitaria (solitary sandpiper)

LARIDAE (JAEGER, GULL, & TERN FAMILY)
Chlidonias niger (black tern)
Larus argentatus (herring gull)
Larus californicus (California gull)
Larus delawarensis (ring-billed gull)
Larus philadelphia (Bonaparte's gull)
Sterna antillarum (least tern)
Sterna caspia (Caspian tern)*
Sterna forsteri (Forster's tern)
Sterna hirundo (common tern)

ORDER CICONIIFORMES (HERONS, IBIS, & NEW WORLD VULTURES)
ARDEIDAE (HERON FAMILY)
Ardea alba (great egret)
Ardea herodias (great blue heron)*
Botaurus lentiginosus (American bittern)*
Bubulcus ibis (cattle egret)*
Butorides virescens (green heron)
Egretta caerulea (little blue heron)
Egretta thula (snowy egret)*
Ixobrychus exilis (least bittern)
Nycticorax nycticorax (black-crowned night-heron)*

CATHARTIDAE (NEW WORLD VULTURE FAMILY)
Cathartes aura (turkey vulture)

THRESKIORNITHIDAE (IBIS FAMILY)
Plegadis chihi (white-faced ibis)*

ORDER COLUMBIFORMES (DOVES)
COLUMBIDAE (DOVE FAMILY)
Columba livia (rock dove)
Zenaida macroura (mourning dove)*

ORDER CORACIIFORMES (KINGFISHERS)
Alcedinidae (Kingfisher Family)
Ceryle alcyon (belted kingfisher)

ORDER CUCULIFORMES (CUCKOOS, ROADRUNNER & ANIS)
CUCULIDAE (CUCKOO FAMILY)
Geococcyx californianus (greater roadrunner)

ORDER FALCONIFORMES (FALCONS)
ACCIPITRIDAE (EAGLE, KITE & HAWK FAMILY)
Accipiter cooperii (Cooper's hawk)
Aquila chrysaetos (golden eagle)
Buteo jamaicensis (red-tailed hawk)*
Buteo lagopus (rough-legged hawk)
Buteo lineatus (red-shouldered hawk)
Buteo regalis (ferruginous hawk)
Buteo swainsoni (Swainson's hawk)
Circus cyaneus (northern harrier)*
Elanus leucurus (white-tailed kite)*
Haliaeetus leucocephalus (bald eagle)
Pandion haliaetus (osprey)

FALCONIDAE (FALCON FAMILY)
Falco columbarius (merlin)
Falco mexicanus (prairie falcon)
Falco peregrinus (peregrine falcon)
Falco sparverius (American kestrel)*

ORDER GALLIFORMES (GROUSE, TURKEY, & QUAIL)
ODONTOPHORIDAE (QUAIL FAMILY)
Callipepla californica (California quail)

PHASIANIDAE (GROUSE FAMILY)
Phasianus colchicus (ringed-neck pheasant)*

ORDER GRUIFORMES (RAILS, LIMPKIN & CRANES)
RALLIDAE (RAIL FAMILY)
Fulica americana (American coot)
Gallinula chloropus (common moorhen)
Porzana carolina (sora)
Rallus limicola (Virginia rail)

GRUIDAE (CRANE FAMILY)
Grus canadensis (sandhill crane)

ORDER PASSERIFORMES (PERCHING BIRDS)
TYRANNIDAE (FLYCATCHER FAMILY)
Contopus cooperi (olive-sided flycatcher)
Contopus sordidulus (western wood-pewee)
Empidonax difficilis (Pacific-slope flycatcher)
Empidonax hammondii (Hammond's flycatcher)
Empidonax oberholseri (dusky flycatcher)
Empidonax traillii (willow flycatcher)
Empidonax wrightii (gray flycatcher)
Myiarchus cinerascens (ash-throated flycatcher)

Pyrocephalus rubinus (vermilion flycatcher)
Sayornis nigricans (black phoebe)
Sayornis saya (Say's phoebe)
Tyrannus verticalis (western kingbird)*

LANIIDAE (SHRIKE FAMILY)
Lanius ludovicianus (loggerhead shrike)*

VIREONIDAE (VIREO FAMILY)
Vireo cassinii (Cassin's vireo)
Vireo gilvus (warbling vireo)

CORVIDAE (JAY & CROW FAMILY)
Corvus corax (common raven)*
Corvus brachyrhynchos (American crow)
Nucifraga columbiana (Clark's nutcracker)

ALAUDIDAE (LARK FAMILY)
Eremophila alpestris (horned lark)

HIRUNDINIDAE (SWALLOW FAMILY)
Petrochelidon pyrrhonota (cliff swallow)*
Hirundo rustica (barn swallow)*
Riparia riparia (bank swallow)
Stelgidopteryx serripennis (northen rough-winged swallow)
Tachycineta bicolor (tree swallow)
Tachycineta thalassina (violet-green swallow)

AEGITHALIDAE (BUSHTIT FAMILY)
Psaltriparus minimus (bushtit)

TROGLODYTIDAE (WREN FAMILY)
Cistothorus palustris (marsh wren)*
Salpinctes obsoletus (rock wren)
Troglodytes aedon (house wren)
Thryomanes bewickii (Bewick's wren)

REGULIDAE (KINGLET FAMILY)
Regulus calendula (ruby-crowned kinglet)
Regulus satrapa (golden-crowned kinglet)

SYLVIIDAE (GNATCATCHER FAMILY)
Polioptila caerulea (blue-gray gnatcatcher)

TURDIDAE (THRUSH FAMILY)
Sialia mexicana (western bluebird)
Catharus guttatus (hermit thrush)
Catharus ustulatus (Swainson's thrush)
Turdus migratorius (American robin)
Ixoreus naevius (varied thrush)

MIMIDAE (MOCKINGBIRD & THRASHER FAMILY)
Mimus polyglottos (northern mockingbird)*
Oreoscoptes montanus (sage thrasher)
Toxostoma redivivum (California thrasher)

STURNIDAE (STARLING FAMILY)
Sturnus vulgaris (European starling)

MOTACILLIDAE (WAGTAIL & PIPIT FAMILY)
Anthus rubescens (American pipit)

BOMBYCILLIDAE (WAXWING FAMILY)
Bombycilla cedrorum (cedar waxwing)
Bombycilla garrulus (bohemian Waxwing)

PARULIDAE (WARBLER FAMILY)
Dendroica coronata (yellow-rumped warbler)
Dendroica nigrescens (black-throated gray warbler)
Dendroica occidentalis (hermit warbler)
Dendroica petechia (yellow warbler)
Dendroica townsendi (Townsend's warbler)
Geothlypis trichas (common yellowthroat)
Oporornis tolmiei (MacGillivray's warbler)
Vermivora celata (orange-crowned warbler)
Vermivora ruficapilla (Nashville warbler)
Wilsonia pusilla (Wilson's warbler)

THRAUPIDAE (TANAGER FAMILY)
Piranga ludoviciana (western tanager)

EMBERIZIDAE (TOWHEE & SPARROW FAMILY)
Calamospiza melanocorys (lark bunting)
Junco hyemalis (dark-eyed junco)
Melospiza georgiana (swamp sparrow)
Melospiza lincolnii (Lincoln's sparrow)
Melospiza melodia (song sparrow)
Passerella iliaca (fox sparrow)
Passerculus sandwichensis (savannah sparrow)
Pipilo maculatus (spotted towhee)
Pooecetes gramineus (vesper sparrow)
Spizella passerina (chipping sparrow)
Zonotrichia atricapilla (golden-crowned sparrow)
Zonotrichia leucophrys (white-crowned sparrow)

CARDINALIDAE (GROSBEAK & BUNTING FAMILY)
Guiraca caerulea (blue grosbeak)
Pheucticus melanocephalus (black-headed grosbeak)
Passerina amoena (Lazuli bunting)

ICTERIDAE (BLACKBIRD & ORIOLE FAMILY)

Agelaius phoeniceus (red-winged blackbird)*
Agelaius tricolor (tricolored blackbird)*
Euphagus cyanocephalus (Brewer's blackbird)*
Icterus bullockii (Bullock's oriole)*
Icterus cucullatus (hooded oriole)
Molothrus ater (brown-headed cowbird)*
Quiscalus mexicanus (great-tailed grackle)*
Sturnella neglecta (western meadowlark)*
Xanthocephalus xanthocephalus (yellow-headed blackbird)*

FRINGILLIDAE FAMILY (FINCH FAMILY)
Carpodacus mexicanus (house finch)
Carduelis pinus (pine siskin)

Carduelis psaltria (lesser goldfinch)
Carduelis tristis (American goldfinch)

PASSERIDAE (OLD WORLD SPARROW FAMILY)
Passer domesticus (house sparrow)*

ORDER PELECANIFORMES (PELICANS & CORMORANTS)
PELECANIDAE (PELICAN FAMILY)
Pelecanus erythrorhynchos (American white pelican)

PHALACROCORACIDAE (CORMORANT FAMILY)
Phalacrocorax auritus (double crested cormorant)

ORDER PICIFORMES (WOODPECKERS)
PICIDAE (WOODPECKER FAMILY)
Colaptes auratus (northern flicker)
Melanerpes formicivorus (acorn woodpecker)
Picoides nuttallii (Nuttall's woodpecker)
Picoides pubescens (downy woodpecker)

ORDER PODICIPEDIFORMES (GREBES)
PODICIPEDIDAE (GREBE FAMILY)
Aechmophorus clarkii (Clark's grebe)*
Aechmophorus occidentalis (western grebe)*
Podiceps auritus (horned grebe)
Podiceps grisegena (red-necked grebe)*
Podiceps nigricollis (eared grebe)*
Podilymbus podiceps (pied-billed grebe)*

ORDER STRIGIFORMES (OWLS)
TYTONIDAE (BARN OWL FAMILY)
Tyto alba (barn owl)*

STRIGIDAE (OWL FAMILY)
Asio flammeus (short-eared owl)*
Asio otus (long-eared owl)*
Bubo virginianus (great horned owl)*
Otus kennicottii (western screech-owl)
Athene cunicularia (burrowing owl)*

Asterisk (*) indicates breeding records for the Refuge

Mammals

ORDER ARTIODACTYLA
BOVIDAE (CATTLE & SHEEP FAMILY)
Bos taurus (cattle)

ORDER CARNIVORA (CARNIVORES)
CANIDAE (DOG FAMILY)
Canis latrans (Coyote)
Vulpes macrotis mutica (San Joaquin kit fox)

FELIDAE (CAT FAMILY)
Felis rufus (bobcat)

MUSTELIDAE (WEASEL FAMILY)
Spilogale gracilis (western spotted skunk)
Mephitis mephitis (striped skunk)
Mustela frenata (long-tailed weasel)
Taxidea taxus (badger)

PROCYONIDAE (RACOON FAMILY)
Procyon lotor (racoon)

ORDER CHIROPTERA
MOLOSSIDAE (FREE-TAILED BAT FAMILY)
Eumops perotis (western mastiff bat)
Tadarida brasiliensis (Mexican free-tailed bat)

ORDER INSECTIVORA
SORICIDAE (SHREW FAMILY)
Sorex ornatus (ornate shrew)
Sorex ornatus relictus (Buena Vista Lake shrew)

TALPIDAE (MOLE FAMILY)
Scapanus latimanus (broad-footed mole)

ORDER LAGOMORPHA
LEPORIDAE (RABBIT & HARE FAMILY)
Lepus californicus (black-tailed jackrabbit)
Sylvilagus audubonii (desert cottontail)

ORDER MARSUPIALIA
DIDELPHIDAE (MARSUPIAL FAMILY)
Didelphis virginiana (Virginia opossum)

ORDER RODENTIA
CASTORIDAE (BEAVER FAMILY)
Castor canadensis (beaver)

SCIURIDAE (SQUIRREL FAMILY)
Ammospermophilus nelsoni (San Joaquin antelope squirrel)
Spermophilus beecheyi (California ground squirrel)

GEOMYIDAE (POCKET GOPHER FAMILY)
Thomomys bottae (Botta's pocket gopher)

HETEROMYIDAE (POCKET MICE & KANGAROO RATS FAMILY)
Chaetodipus californicus (California pocket mouse)
Dipodomys heermanni (Heermann's kangaroo rat)
Dipodomys nitratoides nitratoides (Tipton's kangaroo rat)
Perognathus inornatus (San Joaquin pocket mouse)

MURIDAE (RATS & MICE FAMILY)
Microtus californicus (California vole)
Mus musculus (house mouse)
Ondatra zibethicus (muskrat)
Onychomys torridus (southern grasshopper mouse)
Peromyscus boylii (brush mouse)
Peromyscus californicus (California mouse)
Peromyscus maniculatus (deer mouse)
Peromyscus truei (pinyon mouse)
Rattus norvegicus (Norway rat)
Rattus rattus (black rat or roof rat)
Reithrodontomys megalotis (western harvest mouse)

Reptiles and Amphibians

LIZARDS

Gambelia sila (blunt-nosed leopard lizard)
Phrynosoma coronatum (coast horned lizard)
Uta stansburiana elegans (California side-blotched lizard)
Cnemidophorus tigris (western (California) whiptail)

SNAKES

Pituophis catenifer catenifer (Pacific gopher snake)
Lampropeltis getula californiae (California (common) kingsnakes)
Rhinocheilus lecontei lecontei (western long-nosed snake)
Tantilla hobartsmithi (southwestern black-headed snake)
Crotalus viridis oreganus (western (northern Pacific) rattlesnake)
Arizona elegans occidentalis (California glossy snake)
Thamnophis sirtalis (common garter snake)

AMPHIBIANS

Pseudacris regilla (pacific treefrog)
Spea hammondii (western spadefoot toad)
Rana catesbeiana (bullfrog)

Invertebrates

CLASS INSECTA

ORDER COLEOPTERA (BEETLES AND WEEVILS)

CARABIDAE
Carabidae (ground beetle)
Dryopidae (long-toed water beetles)

CURCULIONIDAE (WEEVILS)
Curculionidae spp. (weevils)

DYTISCIDAE
Agabus disintegratus
Hygrotus spp.
Laccophilus decipiens
Rhantus gutticollis
Thermonectus basillaris (yellow-spotted water beetle)

HYDROPHILIDAE
Berosus ingeminatus
Tropisternus lateralis
Paracymus sp.

ORDER COLLEMBOLA (SPRINGTAILS)

ISOTOMIDAE
Isotomurus palustris

ORDER DIPTERA (FLYS)

SUBORDER BRACHYCERA

DOLICHOPODIDAE (long-legged flies)

EPHYDRIDAE (shore flies)
Ephydra sp.

CHIRONOMIDAE (water midges)
Chironomus decorus (midge)
Chironomus stigmaterus (midge)
Cricotopus spp. (midge)
Goeldichironomus holoprasinus (midge)
Paralauterborniella subcincta (midge)
Paratendipes albimanus (midge)
Tanypus grodhausi (midge)

CULICIDAE (MOSQUITOES)
Culex erythrothorax
Culex pipiens
Culex tarsalis
Ochlerotatus dorsalis
Ochlerotatus melanimon
Ochlerotatus nigromaculis
Aedes vexans

SYRPHIDAE (hover and flower flies)
Eristalis sp.
Helophilus sp.

ORDER EPHEMEROPTERA (MAYFLIES)

BAETIDAE
Centroptilum spp.

ORDER HEMIPTERA

SUBORDER HETEROPTERA (true bugs)
MACROVELIIDAE
Corisella spp. (note only one "s" in the genus name)

NOTONECTIDAE (note family ending "idae)
Notonecta unifasciata (single-banded back swimmer)

SUBORDER HOMOPTERA (hoppers, aphids, scale insects)
APHIDAE (aphids)
CIXIIDAE (cixiid planthoppers)
DELPHACIDAE (delphacid planthoppers)

ORDER HOMOPTERA (SCALE INSECTS, TREEHOPPERS, WHITEFLIES)

APHIDIDAE (APHIDS)
Aphididae (aphid)
Cixiidae (cixiid planthoppers)
Delphacidae (delphacid planthoppers)
Draeculacephala mollipes (leafhopper)

ORDER LEPIDOPTERA (BUTTERLIES & MOTHS)

ARCTIIDAE (TIGER MOTHS)
Apantesis proxima (harnessed tiger moth)
Melipotis jucunda hadeniformis

GEOMETRIDAE (INCH WORMS & LOOPER MOTHS)
Pero macdunnoughi (McDunnough's leaf wing)
Pero meskaria
Semiothisa irrotata irrorata
Synchlora aerata liquoraria

LASIOCAMPIDAE (TENT CATERPILLARS)
Malacosoma disstria

MICROLEPIDOPTERA (SMALL MOTH FAMILY)
Achyra occidentalis
Agriphila attenuata
Amyelois transitella
Archips argyrospila
Bactra verutana chrysea
Comadia suaedivora
Crambus sperryellus
Ephestiodes gilvescentella
Epiblema strenuana
Euchromius californicalis
Euchromius ocelleus
Galleria mellonella
Hellula rogatalis
Homoesoma electellum
Hulstia undulatella
Lipographis truncatella
Mimoschinia rufofascialis
Nomophila nearctica
Ostrinia penitalis
Platynota stultana
Saucrobotys futilalis inconcinnalis
Suleima Helianthana
Udea profundalis

NOCTUIDAE (CUTWORM MOTHS)
Abagrotis barnesi
Acontia coquillettii
Acontia sedata cacola
Agrotis gravis
Agrotis ipsilon
Agrotis subterranea
Agrotis venerabilis
Amphipoerya brunneotra
Apamea cinefacta cenefacta
Apamea cuccilliformis
Autographa californica
Bagisara buxea
Catabena lineolata
Catacola irene
Conochares acutus
Copibryophila angelica
Dargida procinta
Euxoa olivia
Euxoa selenis
Euxoa silens
Heliothis phloxiphagus
Heliothis virescens
Heliothis zea (corn earworm)
Orthosia ferrigera
Peridroma saucia
Platyperigea extima
Protorthodes alfkeni
Protorthodes perforata
Protorthodes texana
Proxenus mindara
Pseudaletia unipuncta
Rynchagrotis exertistigma
Schinia mortua
Scotogramma deffessa
Spaelotis havilae
Spodoptera exigua
Spodoptera praefica
Stibadium spumosum
Trichocosmia drasteroides
Trichoclea antica
Trichoclea decepta
Tridepia nova
Tripchoplusia ni (cabbage looper)

SPHINGIDAE (HAWKMOTH FAMILY)
Hyles lineata (white-lined sphinx)
Manduca sexta (Carolina sphinx
Pachysphinx occidentalis (big poplar sphinx)

ORDER ODONATA
COENAGRIONIDAE
Ischnura perparva (damselfly)
Aeshna interrupts (dragonfly)
Anax junius (dragonfly)
Libellula comanche (dragonfly)
Tarnetrum corruptum (dragonfly)

CLASS BRANCHIOPODA (FAIRY SHRIMP AND WATER FLEAS)

ORDER BRANCHIOPODO
Eulimnadia thompsonii (clam shrimp)
Phyllopod (tadpole shrimp)

TRIOPSIDAE
Triops longicaudatus (tadpole shrimp)

ORDER COPEDOA
EUCOPEDODA
Copepods spp.

CLASS OSTRACODA

ORDER PODOCOPIDA
CYLINDROLEBERIDAE
Cypridopsis spp. (seed shrimp)

CLASS GASTROPODA

ORDER LIMNOPHILA

PLANORBIDAE
Gyraulus spp. (orb snail)
Physa spp. (pouch snail)

Plants

AIZOACEAE (ICE PLANT FAMILY)
Sesuvium verrucosum (sea-purslane,)

ALISMATACEAE (WATER-PLANTAIN OR ARROWHEAD FAMIY)
Echinodorus berteroi (burhead)
Sagittaria longiloba (lance-lobed tule potato)

AMARANTHACEAE (PIGWEED FAMILY)
Amaranthus albus (tumbleweed, white amaranth, tumble pigweed)

APIACEAE (CARROT FAMILY)
Conium maculatum (poison hemlock)

ASCLEPIADACEAE (MILKWEED FAMILY)
Asclepias fascicularis (narrow-leaf milkweed)

ASTERACEAE (SUNFLOWER FAMILY)
Aster subulatus (slender aster)
Cirsium crassicaule (slough thistle)
Gnaphalium palustre (everlasting, cudweed)
Grindelia camporum (gumplant)
Helianthus annus (sunflower)
Hemizonia pungens (common spikeweed)
Isocoma acradenia (pale-leaf golden bush)
Lactuca serriola (prickly lettuce)
Lasthenia californica (California goldfields)
Lasthenia chrysantha (alkali goldfields)
Lasthenia fremontii (Fremont's goldfield)
Lessingia spp. (wooly asters)
Psilocarphus brevissimus (short woolly-heads)
Sonchus oleraceus (common sow thistle)
Xanthium strumarium (cocklebur)

BORAGINACEAE (BORAGE FAMILY)
Amsinckia menziesii (fiddleneck)
Heliotropium curassavicum (wild heliotrope)
Plagiobothrys leptocladus (alkai plagiobothrys)

BRASSICACEAE (MUSTARD FAMILY)
Capsella bursa-pastoris (shepherd's purse)
Guillenia lasiophylla (California mustard)
Lepidium dictyota (alkali pepper-grass)
Sisymbrium irio (desert mustard, London-rocket)
Tropidocarpum gracile (slender tropidocarpum)

CARYOPHYLLACEAE (PINK FAMILY)
Spergularia atrosperma (sand-spurrey)

CHENOPODIACEAE (GOOSEFOOT FAMILY)
Allenrolfea occidentalis (idoine bush)
Atriplex argenta (silverscale saltbush)
Atriplex coronata (crownscale)
Atriplex polycarpa (saltbush)
Atriplex spinifera (saltbush)
Bassia hyssopifolia (five-hook Bassia)
Monolepis nuttalliana (poverty plant)
Salsola tragus (Russian-thistle, tumbleweed)
Suaeda moquinii (bush-seepweed)

CONVOLVULACEAE (MORNING-GLORY FAMILY)
C*ressa truxillensis* (alkali weed)

CRASSULACEAE (STONECROP FAMILY)
Crassula connata (pygmy-weed)

CUSCUTACEAE (DODDER FAMILY)
Cuscuta spp. (dodder)

CYPERACEAE (SEDGE FAMILY)
Cyperus eragrostis (no common name)
Cyperus erythrorhizos (red-rooted cyperus)
Cyperus odoratus (fragrant flatsedge)
Eleocharis macrostachya (common spike-rush)
Scirpus acutus (hardstem bulrush)
Scirpus americanus (Olney's bulrush)
Scirpus robustus (alkali bulrush)
Scirpus saximontanus (Rocky Mountain rush)

EUPHORBIACEAE (SPURGE FAMILY)
Chamaesyce ocellata (Contura Creek spurge)
Eremocarpus setigerus (turkey mullein)

FABACEAE (LEGUME FAMILY)
Astragalus didymocarpus (two-seeded milk-vetch)
Lotus purshianus (Spanish clover)
Lotus wrangelianus (calf lotus)
Medicago polymorpha (California burclover)
Melilotus indicus (sourclover)

FRANKENIACEAE (FRANKENIA FAMILY)
Frankenia salina (alkali heath)

GERANIACEAE (GERANIUM FAMILY)
Erodium cicutarium (red-stemmed filaree)

HYDROPHYLLACEAE (WATERLEAF FAMILY)
Phacelia ciliata (blue flower)

JUNCACEAE (RUSH FAMILY)

Juncus balticus (baltic rush)
Juncus bufonius (toad rush)

LAMIACEAE (MINT FAMILY)
Stachys albens (white hedge-nettle)

LILIACEAE (LILY FAMILY)
Dichelostemma capitatum (blue dick or wild hyacinth)

LYTHRACEAE (LOOSESTRIFE FAMILY)
Ammania coccinea (long-leaved (narrow) ammania)
Lythrum californicum (California loosestrife)

MALVACEAE (MALLOW FAMILY)
Eremalche parryi (Parry's mallow)
Malva parviflora (cheeseweed, bull mallow)
Malvella leprosa (alkali-mallow)

MARSILEACEAE (MARSILEA OR WATER CLOVER FAMILY)
Marsilea vestita (hairy pepperweed, hairy water clover)

ONAGRACEAE (EVENING PRIMROSE FAMILY)
Camissonia campestris (field primrose)

PAPAVERACEAE (POPPY FAMILY)
Eschscholzia californica (California poppy)
Platystemon californicus (cream cups)

POACEAE (GRASS FAMILY)
Avena spp. (oats)
Bromus arizonicus (Arizona brome)
Bromus hordeaceus (soft brome)
Bromus madritensis (foxtail brome)
Crypsis schoenoides (swamp timothy)
Crypsis vaginiflora (prickle grass)
Cynodon dactylon (Bermuda grass)
Deschampsia danthonioides (annual hairgrass)
Distichlis spicata (salt grass)
Echinochloa colona (jungle grass, small barnyard grass)
Echinochloa crus-galli (wild millet, watergrass, barnyard grass)
Glyceria grandis (American mannagrass)
Hordeum depressum (low barley)
Hordeum murinum (barley)
Hordeum vulgare (common barley)
Leptochloa fascicularis (bearded sprangletop)
Oryza sativa (rice)
Paspalum distichum (knot grass)
Poa annua (annual bluegrass)
Polypogon monspeliensis (annual beardgrass)
Puccinellia simplex (alkali grass)
Sporobolus airoides (alkali sacaton)
Vulpia bromoides (six weeks grass)
Vulpia microstachys (few flowered fescue)
Vulpia myuros (foxtail fescue)

POLEMONIACEAE (PHLOX FAMILY)
Gilia tricolor ssp. *diffusa* (birds's eye gilia)

PORTULACACEAE (PURSLANE FAMILY)
Calandrinia ciliata (red maids)

POLYGONACEAE (BUCKWHEAT FAMILY)
Polygonum argyrocoleon (Persian knotweed)
Polygonum lapathifolium (willow-knotweed, nodding smartweed)
Rumex crispus (curly dock)
Rumex salicifolius (willow dock)
Rumex violascens (Mexican dock)

RANUNCULACEAE (BUTTERCUP OR CROWFOOT FAMILY)
Delphinium recurvatum (recurved larkspur)
Myosurus sessilis

SALICACEAE (WILLOW FAMILY)
Populus fremontii (Fremont cottonwood)
Salix gooddingii (Gooding's black willow)

SCROPHULARIACEAE (FIGWORT FAMILY)
Bacopa eisenii (water-hyssop)
Castilleja exserta (purple owl's-clover)
Castilleja attenuatus (valley tassels)
Triphysaria eriantha (butter 'n' eggs)
Veronica peregrina (purslane speedwell)

SOLANACEAE (NIGHTSHADE FAMILY)
Physalis lanceifolia (lance-leafed ground cherry)
Solanum americanum (small flowered nightshade)
Solanum elaeagnifolium (silverleaf-nettle, bull nettle)
Solanum sarrachoides (nightshade)

TYPHACEAE (CATTAIL FAMILY)
Typha angustifolia (narrow-leaved cattail)

TAMARICACEAE (TAMARISK FAMILY)
Tamarix aphylla (athel)

Tamarix chinensis (salt cedar)
Tamarix gallica (summer tamarisk)

VERBENACEAE (VERVAIN FAMILY)

Verbena bracteata (bracted verbena)

ZANNICHELLIACEAE (HORNED-PONDWEED FAMILY)

Zannichellia palustris (horned-pondweed)

Species Lists: Pixley Refuge

Birds

ORDER ANSERIFORMES (SWANS, GEESE & DUCKS)

ANATIDAE (WATERFOWL FAMILY)
Anas acuta (northern pintail)
Anas americana (American wigeon)
Anas crecca (green-winged teal)
Anas cylpeata (northern shoveler)
Anas cyanoptera (cinnamon teal)
Anas platyrhynchos (mallard)
Anas strepera (gadwall)
Anser albifrons (greater white-fronted goose)
Aythya americana (redhead)
Aythya collaris (ring-necked duck)
Branta canadensis (Canada goose)
Bucephala albeola (bufflehead)
Chen caerulescens (snow goose)
Chen rossii (Ross' goose)
Oxyura jamaicensis (ruddy duck)

ORDER CAPRIMULGIFORMES (GOATSUCKERS)

CAPRIMULGIDAE (GOATSUCKER FAMILY)
Chordeiles acutipennis (lesser nighthawk)

ORDER CHARADRIIFORMES (SHOREBIRDS)

CHARADRIIDAE (PLOVER FAMILY)
Charadrius vociferus (killdeer)
Charadrius montanus (mountain plover)
Pluvialis squatarola (black-bellied plover)

RECURVIROSTRIDAE (STILT & AVOCET FAMILY)
Himantopus mexicanus (black-necked stilt)
Recurvirostra americana (American avocet)

SCOLOPACIDAE (SANDPIPER FAMILY)
Actitis macularia (spotted sandpiper)
Calidris alpina (dunlin)
Calidris mauri (western sandpiper)
Calidris minutilla (least sandpiper)
Gallinago gallinago (common snipe)
Limnodromus scolopaceus (long-billed dowitcher
Numenius americanus (long-billed curlew)
Numenius phaeopus (whimbrel)

Tringa flavipes (lesser yellowlegs)
Tringa melanoleuca (greater yellowlegs)

LARIDAE (JAEGER, GULL, & TERN FAMILY)
Childonias niger (black tern)
Larus delawarensis (ring-billed gull)
Sterna forsteri (Forster's tern)

ORDER CICONIIFORMES (HERONS, IBIS, & NEW WORLD VULTURES)

ARDEIDAE (HERON FAMILY)
Ardea alba (great egret)
Ardea herodias (great blue heron)
Bubulcus ibis (cattle egret)
Egretta thula (snowy egret)
Nycticorax nycticorax (black-crowned night-heron)

CATHARTIDAE (NEW WORLD VULTURE FAMILY)
Cathartes aura (turkey vulture)

THRESKIORNITHIDAE (IBIS FAMILY)
Plegadis chihi (white-faced ibis)

ORDER COLUMBIFORMES (PIGEONS & DOVES)

COLUMBIDAE (PIGEON & DOVE FAMILY)
Columba livia (rock dove)
Zenaida macroura (mourning dove)

ORDER FALCONIFORMES (DIURNAL BIRDS OF PREY)

ACCIPITRIDAE (EAGLE, KITE & HAWK FAMILY)
Accipiter cooperii (Cooper's hawk)
Aquila chrysaetos (golden eagle)
Buteo jamaicensis (red-tailed hawk)
Buteo lineatus (red-shouldered hawk)

Buteo regalis (ferruginous hawk)
Bueto swainsoni (Swainson's hawk)
Circus cyaneus (northern harrier)
Elanus leucurus (white-tailed kite)

FALCONIDAE (FALCON)
Falco columbarius (merlin)
Falco sparverius (American kestrel)
Falco peregrinus (peregrine falcon)

ORDER GALLIFORMES (GROUSE, TURKEY, & QUAIL)
PHASIANIDAE (GROUSE FAMILY)
Phasianus colchicus (ringed-neck pheasant)

ORDER GRUIFORMES (RAILS, LIMPKIN & CRANES)
RALLIDAE (RAIL FAMILY)
Fulica americana (American coot)

GRUIDAE (CRANE FAMILY)
Grus canadensis (sandhill crane)

ORDER PASSERIFORMES (PERCHING BIRDS)
TYRANNIDAE (FLYCATCHER FAMILY)
Empidonax difficilis (Pacific-slope Flycatcher)
Myiarchus cinerascens (ash-throated flycatcher)
Sayornis nigricans (black phoebe)
Tyrannus verticalis (western kingbird)

LANIIDAE (SHRIKE FAMILY)
Lanius ludovicianus (loggerhead shrike)

CORVIDAE (JAY & CROW FAMILY)
Aphelocoma californica (western scrub-jay)
Corvus brachyrynchos (common crow)
Corvus corax (American raven)

ALAUDIDAE (LARK FAMILY)
Eremophila alpestris (horned lark)

HIRUNDINIDAE (SWALLOW FAMILY)
Petrochelidon pyrrhonota (cliff swallow)
Tachycineta bicolor (tree swallow)

AEGITHALIDAE (BUSHTIT FAMILY)
Psaltriparus minimus (bushtit)

TROGLODYTIDAE (WREN FAMILY)
Cistothorus palustris (marsh wren)
Troglodytes aedon (house wren)

REGULIDAE (KINGLET FAMILY)
Regulus calendula (ruby-crowned kinglet)

TURDIDAE (THRUSH FAMILY)
Catharus guttatus (hermit thrush)
Turdus migratorius (American robin)

MIMIDAE (MOCKINGBIRD & THRASHER FAMILY)
Mimus polyglottos (northern mockingbird)

STURNIDAE (STARLING FAMILY)
Sturnus vulgaris (European starling)

MOTACILLIDAE (WAGTAIL & PIPIT FAMILY)
Anthus rubescens (American pipit)

PARULIDAE (WARBLER FAMILY)
Dendroica coronata (yellow-rumped warbler)
Dendroica nigrescens (black-throated gray warbler)
Vermivora celata (orange-crowned warbler)
Vermivora ruficapilla (Nashville warbler)
Wilsonia pusilla (Wilson's warbler)

EMBERIZIDAE (TOWHEE & SPARROW FAMILY)
Junco hyemalis (dark-eyed junco)
Melospiza lincolnii (Lincoln's sparrow)
Melospiza melodia (song sparrow)
Passerella iliaca (fox sparrow)
Passerculus sandwichensis (Savannah sparrow)
Pipilo maculatus (spotted towhee)
Spizella passerine (chipping sparrow)
Zonotrichia atricapilla (golden-crowned sparrow)
Zonotrichia leucophrys (white-crowned sparrow)

CARDINALIDAE (GROSBEAK & BUNTING FAMILY)
Passerina amoena (Lazuli bunting)
Pheucticus melanocephalus (black-headed grosbeak)

ICTERIDAE (BLACKBIRD & ORIOLE FAMILY)
Agelaius phoeniceus (red-winged blackbird)
Agelaius tricolor (tricolored blackbird)
Icterus bullockii (Bullock's oriole)
Molothrus ater (brown-headed cowbird)
Sturnella neglecta (western meadowlark)
Xanthocephalus xanthocephalus (yellow-headed blackbird)

FRINGILLIDAE (FINCH FAMILY)
Carduelis lawrencei (Lawrence's goldfinch)
Carduelis psaltria (lesser goldfinch)
Carduelis tristis (American goldfinch)
Carpodacus mexicanus (house finch)

ORDER PICIFORMES (WOODPECKERS)
PICIDAE (WOODPECKER FAMILY)
Colaptes auratus (northern flicker)
Picoides pubescens (downy woodpecker)

ORDER PODICIPEDIFORMES (GREBES)
PODICIPEDIDAE (GREBE FAMILY)
Podiceps nigricollis (eared grebe)
Podilymbus podiceps (pied-billed grebe)

ORDER STRIGIFORMES (OWLS)
STRIGIDAE (OWL FAMILY)
Athene cunicularia (burrowing owl)
Bubo virginianus (great horned owl)

Mammals

ORDER CARNIVORA (CARNIVORES)
CANIDAE (DOG FAMILY)
Canis latrans (coyote)
Vulpes macrotis mutica (San Joaquin kit fox)

MUSTELIDAE (WEASEL FAMILY)
Spilogale gracilis (western spotted skunk)
Mephitis mephitis (striped skunk)
Taxidea taxus (badger)
Mustela frenata (long-tailed weasel)

PROCYONIDAE (RACOON FAMILY)
Procyon lotor (racoon)

ORDER CHIROPTERA
MOLOSSIDAE (FREE-TAILED BAT FAMILY)
Eumops perotis (western mastiff bat)
Tadarida brasiliensis (Mexican free-tailed bat)

ORDER INSECTIVORA
SORICIDAE (SHREW FAMILY)
Sorex ornatus (ornate shrew)

TALPIDAE (MOLE FAMILY)
Scapanus latimanus (broad-footed mole)

ORDER LAGOMORPHA
LEPORIDAE (RABBIT & HARE FAMILY)
Lepus californicus (black-tailed jackrabbit)
Sylvilagus audubonii (desert cottontail)

ORDER RODENTIA
SCIURIDAE (SQUIRREL FAMILY)
Ammospermophilus nelsoni (San Joaquin antelope squirrel)
Spermophilus beecheyi (California ground squirrel)

GEOMYIDAE (POCKET GOPHER FAMILY)
Thomomys bottae (Botta's pocket gopher)

HETEROMYIDAE (POCKET MICE & KANGAROO RATS FAMILY)
Dipodomys heermanni (Heermann's kangaroo rat)
Dipodomys nitratoides (San Joaquin kangaroo rat)
Perognathus inornatus (San Joaquin pocket mouse)

MURIDAE (RATS & MICE FAMILY)
Microtus californicus (California vole)
Mus musculus (house mouse)
Ondatra zibethicus (muskrat)
Peromyscus maniculatus (deer mouse)
Reithrodontomys megalotis (western harvest mouse)

Reptiles and Amphibians

LIZARDS

Gambelia sila (blunt-nosed leopard lizard)
Phrynosoma coronatum (coast horned lizard)
*Uta stansburiana elegans (*California side-blotched lizard)
Cnemidophorus tigris (western (California) whiptail)

SKINKS

Eumeces gilberti (Gilbert's skink)

SNAKES

Pituophis catenifer catenifer (Pacific gopher snake)
Lampropeltis getula californiae (California (common) kingsnakes)
Rhinocheilus lecontei lecontei (western long-nosed snake)
Tantilla hobartsmithi (southwestern black-headed snake)
Crotalus viridis oreganus (western (northern Pacific) rattlesnake)

AMPHIBIANS

Pseudacris regilla (Pacific treefrog)
Bufo boreas halophilus (western (California) toad)
Spea hammondii (western spadefoot toad)
Rana catesbeiana (bullfrog)

Invertebrates

CLASS INSECTA

ORDER LEPIDOPTERA (BUTTERFLIES & MOTHS)

ARCTIIDAE (TIGER MOTH FAMILY)
Apantesis proxima (harnessed tiger moth)
Tetanolita palligera

CULICIDAE (Mosquitoes)
Culex erythrothorax
Culex pipiens
Culex tarsalis
Ochlerotatus dorsalis
Ochlerotatus nigromaculis
Aedes vexans

GEOMETRIDAE (INCH WORM AND LOOPER MOTH FAMILY)
Lobocelta lanceoltata
Orthonama obstipata
Perizoma custodiata
Pero meskaria
Pero modesta
Semiothisa neptaria neptaria

MICROLEPIDOPTERA (SMALL MOTH FAMILY)
Achyra occidentalis
Agriphila attenuata
Bactra verutana chrysea
Comadia suaedivora
Diasticitis fracturalis
Euchromius ocelleus
Eucosma biplagata
Homoeosoma electellum
Lipographis truncatella
Mimoschinia rufofascialis
Nomophila nearctica
Phycitodes albatella mucidella
Plutella xylostella (diamond back or cabbage moth)
Platynota stultana (omnivorous leaf roller)
Suleima baracana
Tinea pallescentella

NOCTUIDAE (CUTWORM MOTH FAMILY)
Acontia coquillettii
Agrotis ipsilon
Agrotis venerabilis arida
Amphipoea lunata
Apamea cinefacta cinefacta
Autographa californica (alfalfa looper)
Caenurgina crassiuscula
Chorizagrotis auxiliaris
Copibryophila angelica
Euxoa pallipennis
Euxoa olivia
Euxoa serricornis
Heliothodes fasciatus
Heliothis zea (corn earworm)
Homoglaea californica
Peridroma saucia
Proxenus mindara
Pseudaletia unipuncta
Pseudorthosia variabilis
Rynchagrotis exertistigma
Scotogramma deffessa
Spodoptera exigua
Spodoptera praefica
Trichoclea antica
Trichoclea decepta
Trichocosmia inornata
Trichoplusia ni
Tridepia nova
Xestia adela

SPHINGIDAE (HAWKMOTH FAMILY)
Manduca sexta (Carolina sphinx)
Hyles lineata (white-lined sphinx)

CLASS BRANCHIOPODA (FAIRY SHRIMP AND WATER FLEAS)

ORDER ANOSTRACA

BRANCHINECTIDAE (FAIRY SHRIMP FAMILY)
Branchinecta lindahli (versatile fairy shrimp)
Branchinecta lynchi (vernal pool fairy shrimp)
Branchinecta mackini (alkali fairy shrimp)

Plants

APIACEAE (CARROT FAMILY)
Eryngium vaseyi (coyote thistle)

ASCLEPIADACEAE (MILKWEED FAMILY)
Asclepias fascicularis (narrow-leaf milkweed)

ASTERACEAE (SUNFLOWER FAMILY)
Chaenactis sp. (pincushion)
Chamomilla suaveolens (pineapple weed)
Hemizonia pallida (Kern tarweed)
Hemizonia pungens (common spikeweed)
Heterotheca grandiflora (telegraph weed)
Isocoma acradenia (pale-leaf golden bush)
Lasthenia californica (California goldfields)
Lasthenia chrysantha (alkali goldfields)
Lasthenia fremontii (Fremont's goldfileds)
Lasthenia minor (goldfields)
Psilocarphus brevissimus (woolly-heads)
Senecio vulgaris (common groundsel)

BORAGINACEAE (BORAGE FAMILY)
Amsinckia menziesii (fiddleneck)
Amsinckia tessellata (checker fiddleneck)
Heliotropium curassavicum (wild heliotrope)
Plagiobothrys leptocladus (alkai plagiobothrys)
Plagiobothrys stipitatus (common vernal pool allocary)

BRASSICACEAE (MUSTARD FAMILY)
Capsella bursa-pastoris (shepherd's purse)
Lepidium acutidens (alkali pepperwort)
Lepidium dictyota (alkali pepper-grass)
Tropidocarpum gracile (slender tropidocarpum)

CALLITRICHACEAE (WATER-STARWORT FAMILY)
Callitriche marginata (water-starwort)

CARYOPHYLLACEAE (PINK FAMILY)
Herniaria cinerea (grey herniaria)
Spergularia atrosperma (sand-spurrey)
Spergularia marina (salt sand-spurrey)

CHENOPODIACEAE (GOOSEFOOT FAMILY)
Allenrolfea occidentalis (idoine bush)
Atriplex lentiformis (big saltbush)
Atriplex polycarpa (allscale)
Atriplex rosea (redscale)
Chenopodium sp. (goosefoot)
Salsola tragus (Russian-thistle)
Suaedea moquinii (sea-blite)

CONVOLVULACEAE (MORNING-GLORY FAMILY)
Cressa truxillensis (alkali weed)

CRASSULACEAE (STONECROP FAMILY)
Crassula aquatica (water pigmy-weed)
Crassula connata (pigmy-weed)

CUCURBITACEAE (GOURD FAMILY)
Cucurbita sp. (gourd)

CUSCUTACEAE (DODDER FAMILY)
Cuscuta spp. (dodder)

CYPERACEAE (SEDGE FAMILY)
Eleocharis macrostachya (commmon spike-rush)

EUPHORBIACEAE (SPURGE FAMILY)
Chamaesyce ocellata (Contura Creek spurge)
Ermocarpus setigerus (turkey mullein)

FABACEAE (LEGUME FAMILY)
Astragalus didymocarpus (two-seeded milk-vetch)
Lotus wrangelianus (calf lotus)
Lupinus bicolor (bicolor lupine)
Medicago polymorpha (California burclover)
Trifolium depauperatum var. *amplectens* (pale sackclover)
Trifolium gracilentum (pinpoint clover)
Trifolium oliganthum (few flower clover)

FRANKENIACEAE (FRANKENIA FAMILY)
Frankenia salina (alkali heath)

GERANIACEAE (GERANIUM FAMILY)
Erodium brachycarpum (filaree)
Erodium cicutarium (red-stemmed filaree)

HYDROPHYLLACEAE (WATERLEAF FAMILY)
Nemophila menziesii (baby blue eyes)

JUNCAGINACEAE (ARROWGRASS FAMILY)
Lilaea scilloides (flowering quillwort)

LAMIACEAE (MINT FAMILY)
Trichostema lanceolatum (vinegar weed)
Trichostema ovatum (San Joaquin bluecurls)

LILIACEAE (LILY FAMILY)
Dichelostemma capitatum (blue dick or wild hyacinth)

MALVACEAE (MALLOW FAMILY)
Eremalche parryi (Parry's mallow)
Malvella leprosa (alkali mallow)

MARSILEACEAE (MARSILEA OR WATER CLOVER FAMILY)
Pilularia americana (American pillwort)

ONAGRACEAE (EVENING PRIMROSE FAMILY)
Camissonia campestris (field primrose)

PAPAVERACEAE (POPPY FAMILY)
Eschscholzia californica (California poppy)
Platystemon californicus (cream cups)

PLANTAGINACEAE (PLANTAIN FAMILY)
Plantago elongata (coast plantain)

POACEAE (GRASS FAMILY)
Avena (oats)
Bromus diandrus (ripgut brome)
Bromus hordeaceus (soft brome)
Bromus madritensis ssp. *rubens* (foxtail brome)
Cynodon dactylon (Bermuda grass)
Deschampsia danthonioides (hairgrass)
Distichlis spicata (salt grass)
Hordeum depressum (low barley)
Hordeum marinum ssp. *gussoneanum* (mediterranean barley)
Hordeum murinum ssp. *glaucum* (glaucous barley)
Hordeum murinum ssp. *leporinum* (farmer's foxtail, hare barley)
Lolium multiflorum (Italian ryegrass)
Poa annua (annual bluegrass)
Polypogon monspeliensis (annual beardgrass)
Puccinellia simplex (alkali grass)
Schismus arabicus (Mediterranean grass)
Sporobolus airoides (alkali sacaton)
Vulpia microstachys (few flowered fescue)
Vulpia myuros (foxtail fescue)

POLEMONIACEAE (PHLOX FAMILY)
Gilia tricolor (birds's eye gilia)
Linanthus liniflorus (flax-flowered linanthus)
Linanthus dichotomus (evening snow)

PORTULACACEAE (PURSLANE FAMILY)
Calandrinia ciliata (red maids)

POLYGONACEAE (BUCKWHEAT FAMILY)
Hollisteria lanta (false spikeflower)
Polygonum sp. (knotweed)

RANUNCULACEAE (BUTTERCUP OR CROWFOOT FAMILY)
Delphinium parryi (San Bernardino larkspur)
Delphinium recurvatum (recurved larkspur)
Myosorus minimus (commmon mousetail)
Myosorus sessilis (tiny mousetail)

SALICACEAE (WILLOW FAMILY)
Salix laevigata (red willow)

SCROPHULARIACEAE (FIGWORT FAMILY)
Castilleja attenuata (valley tassels)
Castilleja exserta (purple owl's-clover)
Collinsia bartsiifolia (white blue eyed mary)
Triphysaria eriantha (butter 'n' eggs)
Veronica peregrina (purslane speedwell)

TAMARICACEAE (TAMARISK FAMILY)
Tamarix chinensis (salt cedar)

Appendix F.
Budget Proposal

Budget Proposal for Kern Refuge

Project Title	*Priority*	*Start Year*	*Completion Year*	*Duration (years)*	*Operational Cost for Startup (thousands)*	*Average Annual Cost (thousands)*	*15-year Total Cost (thousands)*	*Staffing (FTE/ Grade)*	*RONS*
Projects Using Existing Staff and Funding									
Plant 15 acres of riparian vegetation along canals surrounding unit 14	M	2004	2008	4	3.0	3.0	15.0	.05/GS-9	n/a
Restore 400 acres of valley sink scrub vegetation in unit 13.	L	2008	2012	4	31.0	35.0	171.0	.04/GS-9 .04/WG-9	n/a
Prepare a grassland management plan	M	2006	2006	1	-	6.0	6.0	.10/GS-11	n/a
Prepare land protection plan which evaluates alternatives for protecting , enhancing, and linking southern San Joaquin Valley wetlands and associated uplands	H	2002	2005	2	n/a	5.0	15.0	.07/GS-12	n/a
Construct or rehabilitate 9 new blinds in units 5 and 6.	M	2005	2006	2	1.0	4.5	10.0	.06/GS-7 .04/WG-9	n/a
Construct and maintain two photo blinds	L	2005	2018	13	2.0	.3	6.0	-	-
Develop and implement a public use plan	M	2008	2009	2	1.0	2.0	5.0	.03/GS-11	n/a
Conduct habitat management studies to determine how best to manage natural lands to enhance habitat for Buena Vista Lake shrew.	L	2008	2011	4	2.0	15.0	62.0	.25/GS-9	n/a
Establish partnerships with educational institutions and local organizations	L	2006	2018	12	2.0	2.0	26.0	.04/GS-9	n/a
Develop educational materials	M	2008	2018	11	3.0	2.0	25.0	.07/GS-11	n/a
Develop new interpretive signs and displays and new refuge brochure	M	2008	2013	6	21.0	3.0	39.0	.05/GS-9	n/a
Develop kiosk, boardwalk, and enhance pond at refuge entrance	M	2004	2006	2	13.0	2.0	17.0	.08/WG-9 .05/GS-9	n/a
Rehabilitate units 7,7b and 8 and manage as seasonal wetland	M	2004	2018	15	78.0	1.0	93.0	.04/WG-6	n/a
Encourage and provide opportunities for research by other agencies, universities, and institutions	L	2006	2018	13	-	3.2	41.6	.05/GS-11	n/a
Develop a friends group for the refuge	L	2007	2015	9	8.0	3.0	37.0	.05/GS-9	n/a

Project Title	*Priority*	*Start Year*	*Completion Year*	*Duration (years)*	*Operational Cost for Startup (thousands)*	*Average Annual Cost (thousands)*	*15-year Total Cost (thousands)*	*Staffing (FTE/ Grade)*	*RONS*
Purchase general and refuge specific displays for use at fairs, shows, and festivals	M	2004	2018	15	5.0	1.0	20.0	-	n/a
Implement a pro-active cultural resource management program that focuses on meeting the requirements of the National Historic Preservation Act, including consultation, identification, inventory, evaluation, and protection of cultural resources.	L	2009	2018	10	20.0	5.0	70.0	.25/GS-11	n/a
Develop, in partnership with the Tribes and other preservation partners, a program for the interpretation of cultural resources of the Refuge.	L	2009	2018	10	10.0	1.0	20.0	.25/GS-11	n/a
Create and utilize a Memorandum of Agreement with Native American groups to implement the inadvertent discovery clause of the Native American Graves Protection and Repatriation Act (NAGPRA).	L	2009	2010	2	3.0	3.0	9.0	.05/GS-11	n/a
Projects that Require New Staff and/or Funding									
Reduce salt cedar cover on the Refuge by 90 percent over the next 10 years	M	2005	2014	10	120.0	50.0	620.0	0.7/WG-9 0.7/WG-6	97012
Rehabilitate unit 14 and manage as new 1,200 acre moist soil unit	H	2004	2018	15	300.0	18.0	570.0	.35/WG-9	97007 97004
Expand aerial surveys of waterfowl and ground surveys of shorebirds, waterbirds, and raptors	H	2005	2018	14	25.0	45.0	655.0	.5/GS-7	98004
Hire a full time outdoor recreation planner (shared with Pixley Refuge)	M	2008	2018	11	15.0	27.0	317.0	0.5/GS-9	00004
Implement Poso Creek flood water management agreement developed with adjacent land owners	M	2007	2018	12	207.0	10.0	337.0	.10/GS-13	98001
Construct and maintain a new tour route around unit 7	M	2006	2018	13	183.0	6.0	261.0	.01/WG-9	97013

Budget Proposal for Pixley Refuge

Project Title	*Priority*	*Start Year*	*Completion Year*	*Duration (years)*	*Operational Cost for Startup (thousands)*	*Average Annual Cost (thousands)*	*15-year Total Cost (thousands)*	*Staffing (FTE/ Grade)*	*RONS*
Projects Using Existing Staff and Funding									
Conduct habitat management studies to determine how best to manage natural lands for Tipton's kangaroo rat and blunt-nosed leopard lizard	M	2007	2010	4	13.0	15.0	63.0	.25/GS-9	n/a
Seek approval for and prepare a land protection plan which evaluates opportunities for protection of blocks of habitat for Tipton kangaroo rat between and around Pixley Refuge and Allensworth Natural Area	H	2006	2008	2	n/a	5.0	10.0	.07/GS-12	n/a
Maintain and enhance riparian area.	M	2005	2018	14	3.0	3.0	45.0	.05/WG-8	n/a
Plant and maintain 10 acres of riparian habitat along the service ditch and Deer Creek	L	2006	2008	3	3.0	1.0	6.0	.02/WG-9	n/a
Prepare grassland management plan	M	2006	2006	1	1.0	6.0	7.0	.10/GS-11	n/a
Develop 272-acre Turkey Tract into grain and pasture unit	H	2007	2018	12	86.0	2.0	110.0	.02/WG-9	n/a
Expand aerial surveys of waterfowl and ground surveys of shorebirds, waterbirds, and raptors	H	2005	2018	14	1.0	8.0	113.0	.06/GS-9	n/a
Develop an implement a visitor services plan	L	2006	2007	2	1.0	2.0	5.0	.03/GS-9	n/a
Develop and maintain a pullout and interpretive displays at the Turkey Tract grain and pasture unit	L	2006	2018	13	40.0	3.0	79.0	.01/GS-9	n/a
Establish partnerships with educational institutions and local organizations	L	2007	2018	12	1.0	2.0	25.0	.04/GS-9	n/a
Develop educational materials	L	2007	2018	12	3.0	2.0	23.0	.07/GS-11	n/a
Develop new interpretive signs and displays and new refuge brochure	L	2006	2012	7	21.0	3.0	42.0	.05/GS-9	n/a
Develop a friends group for the refuge	M	2006	2015	10	7.0	3.0	37.0	.05/GS-9	n/a
Encourage and provide opportunities for research by other agencies, universities, and institutions	L	2005	2018	14	-	3.2	44.8	.05/GS-11	n/a

Project Title	*Priority*	*Start Year*	*Completion Year*	*Duration (years)*	*Operational Cost for Startup (thousands)*	*Average Annual Cost (thousands)*	*15-year Total Cost (thousands)*	*Staffing (FTE/ Grade)*	*RONS*
Conduct archeological surveys prior to initiating projects that may disturb historic or archeological sites	H	2004	2018	15	5.0	2.0	35.0	.03/GS-11	n/a
Work with the State Historic Preservation Office and universities to document and interpret any discovered sites	M	2005	2018	14	2.0	2.0	30.0	.05/GS-9	n/a
Projects that Require New Staff and/or Funding									
Hire a full time outdoor recreation planner (shared with Kern Refuge)	M	2008	2018	11	15.0	27.5	317.0	0.5/GS-9	00004
Expand surveying and monitoring for special status species. Prepare an inventory and monitoring plan	H	2008	2018	11	25.0	53.0	608.0	1.0/GS-7	97002
Conduct law enforcement patrols of known cultural resources sites	M	2005	2018	14	1.0	1.0	15.0	.02/GS-9	03003

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Appendix H. Glossary

Acre-feet (AF). An acre-foot of water is the amount of water required to cover 1 acre of land to a depth of 1 foot; it is the equivalent of 325,851 gallons.

Adaptive Management. The rigorous application of management, research, and monitoring to gain information and experience necessary to assess and modify management activities. A process that uses feedback from refuge research and monitoring and evaluation of management actions to support or modify objectives and strategies at all planning levels.

Alkalinity. Refers to the extent to which water or soils contain soluble mineral salts. Waters with a pH greater than 7.4 are considered alkaline.

Alluvium. Clay, sand, or other sediment that is gradually deposited by moving water (see also alluvial-fan).

Alternatives. Different sets of objectives and strategies or means of achieving refuge purposes and goals, helping fulfill the Refuge System mission, and resolving issues. (1) A reasonable way to fix the identified problem or satisfy the stated need. (40 CFR 150.2) (2) Alternatives are different means of accomplishing refuge purposes and goals and contributing to the System mission (Draft Service Manual 602 FW 1.5).

Animal Unit Month (AUM). The amount of forage necessary to maintain one 1,000-pound animal for one month.

Aquatic. Pertaining to water, in contrast to land. Living in or upon water.

Aquatic Habitat. The physical, chemical, and vegetative features that occur within the water of lakes, ponds, reservoirs, rivers, irrigation canals, and other bodies of water.

Aquifer. An underground layer of porous rock, sand, or gravel containing large amounts of water.

Artifact. An object made by humans; usually in reference to primitive tools, vessels, weapons, etc.

Basin. A depressed area with little or no surface water; an area where water flows in, but where surface water does not flow out.

Biodiversity (biological diversity). Refers to the full range of variability within and among biological communities, including genetic diversity, and the variety of living organisms, assemblages of living organisms, and biological processes. Diversity can be measured in terms of the number of different items (species, communities) and their relative abundance, and it can include horizontal and vertical variability. The variety of life, including the variety of living organisms, the genetic differences among them, and the communities in which they occur.

Biological Control. The use of organisms or viruses to control weeds or other pests.

Biological Integrity. Biotic composition, structure, and functioning at the genetic, organism, and community levels consistent with natural conditions, including the natural biological processes that shape genomes, organisms, and communities.

Carcinogenic. Any substance that produces or causes cancer.

Carnivore. An animal that kills and eats other animals.

Categorical Exclusion (CE, CX, CATEX, CATX). A category of actions that do not individually or cumulatively have a significant effect on the human environment and have been found to have no such effect in procedures adopted by a Federal agency pursuant to the National Environmental Policy Act (40 CFR 1508.4).

CFR. Code of Federal Regulations.

Community: The combined populations of all organisms in a given area, and their interactions. For example, the frogs, fish, algae, cattails, and lily pads in a backyard pond make up a community.

Compatible Use. A wildlife-dependent recreational use or any other use of a refuge that, in the sound professional judgment of the Director, will not materially interfere with or detract from the fulfillment of the Mission of the System or the purposes of the refuge (Draft Service Manual 603 FW 3.6).

Comprehensive Conservation Plan (CCP). A document that describes the desired future conditions of the refuge or planning unit; and provides long-range guidance and management direction to accomplish the purposes of the refuge, helps fulfill the mission of the Refuge System; maintains and, where appropriate, restores the ecological integrity of each refuge and the Refuge System; helps achieve the goals of the National Wilderness Preservation System; and meets other mandates.

Concern. See Issue.

Cultural Resource. The physical remains of human activity (artifacts, ruins, burial mounds, petroglyphs, etc.) and conceptual content or context (as a setting for legendary, historic, or prehistoric events, such as a sacred area of native peoples) of an area. It includes historical, archaeological and architectural significant resources.

Cultural Resource Inventory. A professionally conducted study designed to locate and evaluate evidence of cultural resources present within a defined geographic area. Inventories may involve various levels, including background literature search, comprehensive field examination to identify all exposed physical manifestations of cultural resources, or sample inventory to project site distribution and density over a larger area. Evaluation of identified cultural resources to determine eligibility for the National Register follows the criteria found in 36 CFR 60.4 (Service Manual 614 FW 1.7).

Cultural Resource Overview. A comprehensive document prepared for a field office that discusses, among other things, its prehistory and cultural history, the nature and extent of known cultural resources, previous research, management objectives, resource management conflicts or issues, and a general statement on how program objectives should be met and conflicts resolved. An overview should reference or incorporate information from a field offices background or literature search described in Section VIII of the Cultural Resource Management Handbook (Service Manual 614 FW 1.7).

Easement. A privilege or right that is held by one person or other entity in land owned by another.

Ecological Integrity. The integration of biological integrity, natural biological diversity, and environmental health; the replication of natural conditions.

Ecosystem. The sum of all interacting parts of the environment and associated ecological communities within a particular area; an ecological system. Many levels of ecosystems have been recognized. Very few, if any ecosystems are self-contained; most influence, or are influenced by, components or forces outside the system. For administrative purposes, we have designated 53 ecosystems covering the United States and its possessions. These ecosystems generally correspond with watershed boundaries, and their sizes and ecological complexity vary.

Effect. A change in a resource, caused by a variety of events including project attributes acting on a resource attribute (direct), not directly acting on a resource attribute (indirect), another project attributes acting on a resource attribute (cumulative), and those caused by natural events (e.g., seasonal change).

Emergent Vegetation. Rooted, aquatic plants that have most of their vegetative (nonroot) parts above water.

Endemic Species. Plants or animals that occur naturally in a certain region and whose distribution is relatively limited to a particular locality.

Endangered Species. Any species that is in danger of extinction throughout all or a significant portion of its range and listed as such by the Secretary of the Interior in accordance with the Endangered Species Act of 1973. Endangered species are afforded protection under the Act as amended and under various State laws for State-listed species.

Environmental Assessment (EA). A concise public document, prepared in compliance with the National Environmental Policy Act, that briefly discusses the purpose and need for an action, alternatives to such action, and provides sufficient evidence and analysis of impacts to determine whether to prepare an environmental impact statement or finding of no significant impact (40 CFR 1508.9).

Environmental Health. Abiotic composition, structure, and functioning of the environment consistent with natural conditions, including the natural abiotic processes that shape the environment

Ethnography. The branch of anthropology that deals descriptively with specific cultures, especially those of non-literate peoples.

Evapotranspiration. The collective processes by which water is transferred from the surface of the earth, including from the soil and the surface of water-bodies (through evaporation) and from plants (through transpiration).

Exotic and Invading Species.(Noxious Weeds). Plant species designated by Federal or State law as generally possessing one or more of the following characteristics: aggressive or difficult to manage; parasitic; a carrier or host of serious insects or disease; or nonnative, new, or not common to the United States, according to the Federal Noxious Weed Act (PL 93-639), a noxious weed is one that causes disease or has adverse effects on man or his environment and therefore is detrimental to the agriculture and commerce of the Unite States and to the public health.

Fallow. **Allowing land that normally is used for crop production to lie idle.**

Finding of No Significant Impact (FONSI). A document prepared in compliance with the National Environmental Policy Act, supported by an environmental assessment, that briefly presents why a Federal action will have no significant effect on the human environment and for which an environmental impact statement, therefore, will not be prepared (40 CFR 1508.13).

Flyway. A route taken by migratory birds between their breeding grounds and their wintering grounds. Four primary migration routes have been identified for birds breeding in North America: the Pacific, Central, Mississippi, and Atlantic Flyways.

Foraging. The act of feeding; another word for feeding.

Forbs. Herbaceous dicotyledonous plants.

Fragmentation. The process of reducing the size and connectivity of habitat patches.

GIS. Geographic Information System. Refers to such computer mapping programs as ArcView, ArcInfo, ERDAS, etc.

Goal. Descriptive, open-ended, and often broad statement of desired future conditions that conveys a purpose but does not define measurable units (Draft Service Manual 620 FW 1.5).

Grain. A single, hard seed of a cereal grass.

Habitat. Suite of existing environmental conditions required by an organism for survival and reproduction. The place where an organism typically lives.

Integrated Pest Management (IPM). Methods of managing undesirable species, such as weeds, including education; prevention, physical or mechanical methods or control; biological control; responsible chemical use; and cultural methods.

Invertebrate. Animals that do not have backbones. Included are insects, spiders, mollusks (clams, snails, etc.), and crustaceans (shrimp, crayfish, etc.).

Irrigation Drainwater. Ideally, subsurface water which flows from irrigated land and generally transports higher concentrations of dissolved salts than the water applied to the land.

Irrigation Return Flow. Water which reaches surface drainage by overland flow or through groundwater discharge as a result of applied or natural irrigation.

Issue. Any unsettled matter that requires a management decision, e.g., an initiative, opportunity, resource management problem, threat to the resources of the unit, conflict in uses, public concern, or the presence of an undesirable resource condition.

Migratory Bird. A bird that seasonally moves between geographic areas. Birds that migrate south of Mexico for the winter are considered neotropical migrants.

Mitigation. To avoid or minimize impacts of an action by limiting the degree or magnitude of the action; to rectify the impact by repairing, rehabilitating, or restoring the affected environment; to reduce or eliminate the impact by preservation and maintenance operations during the life of the action.

Moist-Soil. A process where water is drawn down intentionally or naturally to produce mudflats (i.e., moist soil) that are required for germination of many desirable plants.

National Environmental Policy Act (NEPA). An act which encourages productive and enjoyable harmony between humans and their environment, to promote efforts that will prevent or eliminate damage to the environment and atmosphere, to stimulate the health and welfare of humans. The act also established the Council on Environmental Quality (CEQ). Requires all agencies, including the Service, to examine the environmental impacts of their actions, incorporate environmental information, and use public participation in the planning and implementation of all actions. Federal agencies must integrate NEPA with other planning requirements, and prepare appropriate NEPA documents to facilitate better environmental decision making (from 40 CFR 1500).

National Wildlife Refuge (Refuge or NWR). A designated area of land or water or an interest in land or water within the system, including national wildlife refuges, wildlife ranges, wildlife management areas, waterfowl production areas, and other areas (except coordination areas) under the Service jurisdiction for the protection and conservation of fish and wildlife. A complete listing of all units of the Refuge System may be found in the current "Report of Lands Under Control of the U.S. Fish and Wildlife Service."

National Wildlife Refuge System, Refuge System, or System. Various categories of areas that are administered by the Secretary for the conservation of fish and wildlife, including species that are threatened with extinction; all lands, waters, and interest therein administered by the Secretary as wildlife refuges; areas for the protection and conservation of fish and wildlife that are threatened with extinction; wildlife ranges; game ranges; wildlife management or waterfowl production areas.

Native Species. Species that normally live and thrive in a particular ecosystem.

NEPA. National Environmental Pollicy Act of 1969.

No Action Alternative. An alternative under which existing management would be continued.

Objective. A concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it, and who is responsible for the work. Objectives derive from goals and provide the basis for determining strategies, monitoring refuge accomplishments, and evaluating the success of strategies. Make objectives attainable, time-specific, and measurable.

Plant Community. An assemblage of plant species of a particular composition. The term can also be used in reference to a group of one or more populations of plants in a particular area at a particular point in time; the plant community of an area can change over time due to disturbance (e.g., fire) and succession.

Playa. A shallow basin where water collects and is evaporated.

Population: All the members of a single species coexisting in one ecosystem at a given time.

Preferred Alternative. This is the alternative determined (by the decision maker) to best achieve the Refuge purpose, vision, and goals; contributes to the Refuge System mission, addresses the significant issues; and is consistent with principles of sound fish and wildlife management. The Service's selected alternative at the Draft CCP stage.

Prescribed Fire. The skillful application of fire to natural fuels under conditions of weather, fuel moisture, soil moisture, , etc., that allows confinement of the fire to a predetermined area and produces the intensity of heat and rate of spread to accomplish planned benefits to one or more objectives of habitat management, wildlife management, or hazard reduction.

Priority Public Uses. Compatible wildlife-dependent recreation uses (hunting, fishing, wildlife observation and photography, and environmental education and interpretation).

Proposed Action. The Service's proposed action for Comprehensive Conservation Plans is to prepare and implement the CCP.

Public Involvement. A process that offers impacted and interested individuals and organizations an opportunity to become informed about, and to express their opinions on Service actions and policies. In the process, these views are studied thoroughly and thoughtful consideration of public views is given in shaping decisions for refuge management.

Public Scoping. See public involvement.

Purposes of the Refuge. "The purposes specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, refuge unit, or refuge subunit." For refuges that encompass congressionally designated wilderness, the purposes of the Wilderness Act are additional purposes of the refuge.

Raptor. A bird of prey, such as a hawk, eagle, or owl.

Refuge. Short of National Wildlife Refuge.

Refuge Operating Needs System (RONS). The Refuge Operating Needs System is a national database that contains the unfunded operational needs of each refuge. We include projects required to implement approved plans and meet goals, objectives, and legal mandates.

Refuge Purposes. The purposes specified in or derived from the law, proclamation, executive order, agreement, public land order, donation document, or administrative memorandum establishing, authorizing, or expanding a refuge, a refuge unit, or refuge subunit (Draft Service Manual 602 FW 1.5).

Refuge Revenue Sharing Program or RRSP. Provides payments to counties in lieu of taxes using revenues derived from the sale of products from refuges.

Salinity. An expression of the amount of dissolved solids in water.

Shorebirds. Long-legged birds, also known as waders, belonging to the Order Charadriiformes that use shallow wetlands and mud flats for foraging and nesting.

Sound Professional Judgement. A finding, determination, or decision that is consistent with principles of sound fish and wildlife management and administration, available science and resources, and adherence to the requirements of the Refuge Administration Act and other applicable laws.

Species. A distinctive kind of plant or animal having distinguishable characteristics, and that can interbreed and produce young. A category of biological classification.

Step-Down Management Plan. A plan that provides specific guidance on management subjects (e.g., habitat, public use, fire, safety) or groups of related subjects. It describes strategies and implementation schedules for meeting CCP goals and objectives.

Strategy. A specific action, tool, or technique or combination of actions, tools, and techniques used to meet unit objectives (Draft Service Manual 602 FW 1.5).

Threatened Species. Any species that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range, and one that has been designated as a threatened species in the Federal Register by the Secretary of the Interior. Threatened species are afforded protection under the Endangered Species Act of 1973.

Upland. An area where water normally does not collect and where water does not flow on an extended basis. Uplands are non-wetland areas.

Vernal Pool. Seasonally flooded depressions found on ancient soils with an impermeable layer such as a hardpan, claypan, or volcanic basalt. The impermeable layer allows the pools to retain water much longer then the surrounding uplands; nonetheless, the pools are shallow enough to dry up each season. Vernal pools often fill and empty several times during the rainy season. Only plants and animals that are adapted to this cycle of wetting and drying can survive in vernal pools over time.

Vision Statement. A concise statement of what the planning unit should be, or what we hope to do, based primarily upon the Refuge System mission and specific refuge purposes, and other mandates. We will tie the vision statement for the refuge to the mission of the Refuge System; the purpose(s) of the refuge; the maintenance or restoration of the ecological integrity of each refuge and the Refuge System; and other mandates.

Waterfowl. A group of birds that include ducks, geese, and swans (belonging to the order Anseriformes).

Watershed. The entire land area that collects and drains water into a river or river system.

Wilderness Review. The process we use to determine if we should recommend Refuge System lands and waters to Congress for wilderness designation. The wilderness review process consists of three phases: inventory, study, and recommendation. The inventory is a broad look at the refuge to identify lands and waters that meet the minimum criteria for wilderness. The study evaluates all values (ecological, recreational, cultural), resources (e.g., wildlife, water, vegetation, minerals, soils), and uses (management and public) within the Wilderness Study Area. The findings of the study determine whether or not we will recommend the area for designation as wilderness.

Wildfire. A free-burning fire requiring a suppression response; all fire other than prescribed fire that occurs on wildlands (Service Manual 621 FW 1.7).

Wildlife. All nondomesticated animal life; included are vertebrates and invertebrates.

Wildlife-Dependent Recreational Use. "A use of a refuge involving hunting, fishing, wildlife observation and photography, or environmental education and interpretation." These are the six priority public uses of the Refuge System as established in the National Wildlife Refuge System Administration Act, as amended. Wildlife-dependent recreational uses, other than the six priority public uses, are those that depend on the presence of wildlife. We also will consider these other uses in the preparation of refuge CCPs; however, the six priority public uses always will take precedence.

Appendix I.
List of Preparers

List of Planning Team Members and Persons Responsible for Preparing this Document

Jack Allen	Former Wildlife Biologist, Kern Refuge Complex
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Pam Williams, PhD.	Wildlife Biologist, Kern Refuge Complex

Appendix J.
Land Protection Plan

Land Protection Plan
Pixley National Wildlife Refuge

Tulare County, California

Approved by:

_____ _____

Manager, California/Nevada Operations
Sacramento, California

Date

Table of Contents

Land Protection Plan

Pixley National Wildlife Refuge
Tulare County, California

Introduction

This draft Land Protection Plan outlines resource protection needs and priorities, and habitat protection methods the U.S. Fish and Wildlife Service (Service) would use for acquiring land within the approved refuge boundary of the Pixley National Wildlife Refuge (Refuge) in Tulare County, California. The Pixley Master Plan developed in 1984 evaluated the environmental effects of an approved Refuge boundary of 10,308 acres. Of these 10,308 acres, 6,389 acres are owned in fee title by the Service. This land protection plan identifies fee title, conservation and agricultural easements, cooperative agreements, or memorandum of understanding as means of acquiring appropriate native or naturalized lands out of the approximate remaining 3,919 acres within the approved Refuge boundary. The purposes of the Refuge include conservation and protection of migratory birds and threatened and endangered species.

There are numerous landowners within the approved Refuge boundary. Nothing in this plan constitutes an offer to purchase private property, or an usurpation of the authority of the State of California, Tulare County or any other jurisdiction to regulate land use within the approved Refuge boundary. This plan is intended to guide subsequent land protection activities to the availability of funds and other constraints. To complement this plan, the Comprehensive Conservation Plan includes management objectives, goals, and strategies for the Refuge.

Project Description

Pixley Refuge is surrounded by agricultural lands that support a growing dairy industry. Interstate 99 is 9 miles to the east and State Highway 43 is 3 miles to the west; both run north and south and are connected by Avenue 56 which is approximately 2 miles south of the Pixley Refuge. The closest towns are Alpaugh, 8 miles to the west with a population of 900, and Earlimart, 8 miles to the east with a population of 900. Approximately 30 miles north of Pixley Refuge on Interstate 99 are the cities of Tulare, Visalia, and Hanford, which have a combined population of approximately 167,750.

Historically, the southern San Joaquin Valley was a vast sea that as recently as one hundred years ago covered at least 800 square miles in Tulare, Kings, and Kern Counties. Rivers and streams flowed from the Sierra Nevada Mountains to the east of the valley and lush wetlands, riparian corridors, and lake basins were common. The largest lake basin, Tulare Lake, served as an endpoint and lowest point in the valley for this system and outflow to the ocean via the Sacramento-San Joaquin Delta to the north occurred in flood years.

The Refuge is located in the southern San Joaquin Valley, with portions of the Refuge lying within the historic Tulare Lake Bed. Vegetation is of the Valley grassland association, with some riparian plants along Deer Creek. The Refuge ranges from 200 feet msl to 260 feet msl. About 950 acres of the Refuge have been developed for wintering and migrating waterfowl. Agriculture, including grazing and intensely managed water, primarily for irrigating crops the valley have altered the area .

The southern San Joaquin Valley is now characterized by a patchwork of agricultural fields, orchards, and vineyards connected to, and dependent on, a network of water districts and water delivery canals.

Native wetlands are virtually nonexistent because the water has been diverted for agricultural purposes. When flooding occurs, historic lake basins, marshes, streams, and rivers, although converted to agricultural lands, carry the majority of the water through the valley. However, sheet flooding across urban and upland areas is common.

From 1976 to 1980, 70 percent of habitat used by the endangered blunt-nosed leopard lizard had been lost to urbanization and agriculture. Other species dependent on upland habitat such as the San Joaquin kit fox and Tipton kangaroo rat, both endangered species, have suffered fates similar to the blunt-nosed leopard lizard. Range contraction, lack of corridors, and competition with introduced species continue to adversely impact these animals.

Today, the Refuge represents one of the largest blocks of contiguous uplands in the southern San Joaquin Valley. Resident, migratory, and threatened and endangered species as well as native plants continue to use these lands throughout the year. While some of these species also occur on and use private property, their last stronghold in the southern San Joaquin Valley may be the Refuge.

Purpose and Goals of the Pixley NWR

The purpose for Refuge is to provide wintering habitat for migratory birds and protect and provide habitat for the threatened and endangered species that are found on the Refuge. Threatened and endangered species found on the Refuge include the blunt-nosed leopard lizard, Tipton kangaroo rat, San Joaquin kit fox, and the vernal pool fairy shrimp.

The following goals of the Refuge reflect the core mission of the U.S. Fish and Wildlife Service to protect wildlife resources of national importance while providing opportunities for the public to appreciate and enjoy the natural heritage of the area.

Endangered Species
Protect, preserve, and restore alkali sink scrub, saltbush scrub, iodine bush scrub and grassland habitats in the southern San Joaquin Valley to contribute to the recovery plan goals for the San Joaquin kit fox, blunt-nosed leopard lizard, and Tipton kangaroo rat.

Migratory Birds
Provide high quality wintering and migratory habitat for migratory birds in the southern San Joaquin Valley, with an emphasis on waterfowl, sandhill cranes, and other waterbirds.

Biodiversity
Restore and maintain a representative example of Tulare Basin grassland and riparian habitat on Pixley Refuge.

Visitor Services
Provide visitors with wildlife-dependent recreation, interpretation, and education opportunities which foster an appreciation and understanding of Pixley Refuge's unique wildlife and plant communities.

Proposed Action and Objectives

The Service approved the 1984 Pixley Master Plan, which allowed for an expanded 10,308 acre Refuge boundary. The Service is updating this Land Protection Plan as part of the Comprehensive Conservation Planning process in order to clarify our acquisition priorities. This Land Protection Plan identifies different ways to protect and provide habitat and secure corridors between the refuge and other conservation areas within the valley.

Threats to and Status of the Resource to be Protected

Native or naturalized lands in the Southern San Joaquin Valley very often provide good wildlife habitat and may support endangered species including the blunt-nosed leopard lizard, Tipton kangaroo rat, San Joaquin kit fox, and the threatened vernal pool fairy shrimp. Not only will native or naturalized lands provide habitat for threatened and endangered species it will also provide habitat for other native wildlife as well. Much of the habitat in the Southern San Joaquin Valley including land within and adjacent to the approved Refuge boundary has been converted for intensive agricultural use. These uses include row crops, orchards, and vineyards, but currently the largest threat to native habitat in the area is dairies.

These operations require large tracts of land to support the primary dairy facility as well as additional land to provide feed. Presently, there are at least nine dairies and supporting agricultural lands located either within or adjacent to the existing refuge and the approved Refuge boundary. With large tracts of land currently for sale within and adjacent to the approved Refuge boundary, conversion of additional native and naturalized lands to dairies is likely.

Willing Seller Policy

Service policy is to acquire lands only from willing participants under general authorities such as the Fish and Wildlife Act of 1956, the Endangered Species Act, the Migratory Bird Conservation Act, and the Refuge Recreation Act. Landowners within the approved Refuge boundary who do not wish to sell their property or any other interest in their property are under no obligation to enter into negotiations or to sell to the Service.

The Service, like other federal agencies, has been given the power of eminent domain, which allows the use of condemnation to acquire lands and other interest in land for the public good. This power, however, is rarely used and is not expected to be used in this project. The Service usually acquires land from willing participants and is not often compelled to buy specific habitats within a specific time frame.

In all cases the Service is required by law to offer 100 percent of fair-market value for lands to be purchased as determined by an approved appraisal that meets professional standards and federal requirements.

Under the Uniform Relocation Assistance and Real Property Acquisition Policies Act, landowners who sell their property to the Service are eligible for certain benefits and payments which include:

- Reimbursement of reasonable moving and related expenses or certain substitute payments.
- Replacement housing payment under certain conditions.
- Relocation assistance services to help locate replacement housing/farm/or business.
- Reimbursement of certain necessary and reasonable expenses incurred in selling real property to the Federal Government.

Habitat Protection Methods

A variety of habitat protection methods can be used to conserve the natural resources of the Pixley NWR within its approved refuge boundary. These methods range form the acquisition of land by the Service in fee title, conservation and agricultural easements, cooperative agreements, or memorandum of understanding. Using these efforts to protect native habitats within the approved refuge boundary will assist in the recovery of native plant and wildlife population in the Southern San Joaquin Valley.

On lands owned and managed by public agencies, cooperative agreements and coordinated planning/management efforts, including shared resources could be used to conserve natural resources within the approved refuge boundary. The Service could also acquire fee title, conservation or agricultural easements, long-term leases, and/or cooperative agreements with willing public agencies and willing landowners through purchase, donation, transfer, exchange, or written agreement.

Conservation Easements
Conservation easements provide the Service the opportunity to manage lands for their fish and wildlife habitat values. The easement would preclude uses inconsistent with the Refuges management objectives. In effect, the landowner transfers certain development and management rights the Service for management purposes as specified in the easement. Property taxes would remain the responsibility of the landowner.

Easement would likely be useful when (1) most, but not all, of the private landowner's uses are compatible with the Refuge's management objectives, and (2) the current owner desires to retain ownership of the land and continue compatible uses under the terms mutually agreed to in the easement.

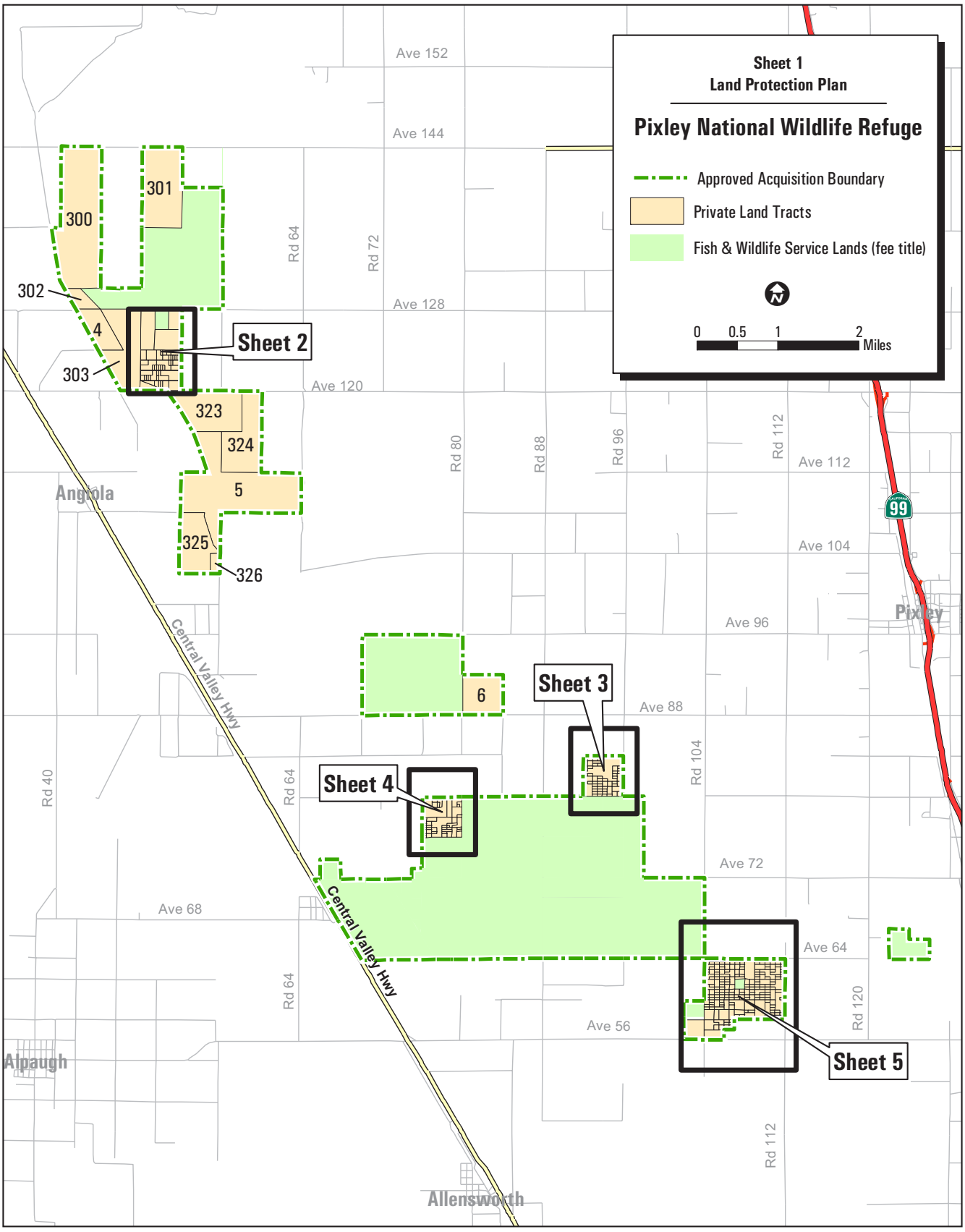
Land uses that are normally restricted under the terms of a conservation easement include, but are not limited to:
- Development rights (residential, industrial, etc.)
- Alteration of the area's natural topography
- Uses adversely affecting the area's flora and fauna
- Private hunting and fishing leases
- Public access rights
- Alteration on natural water regime

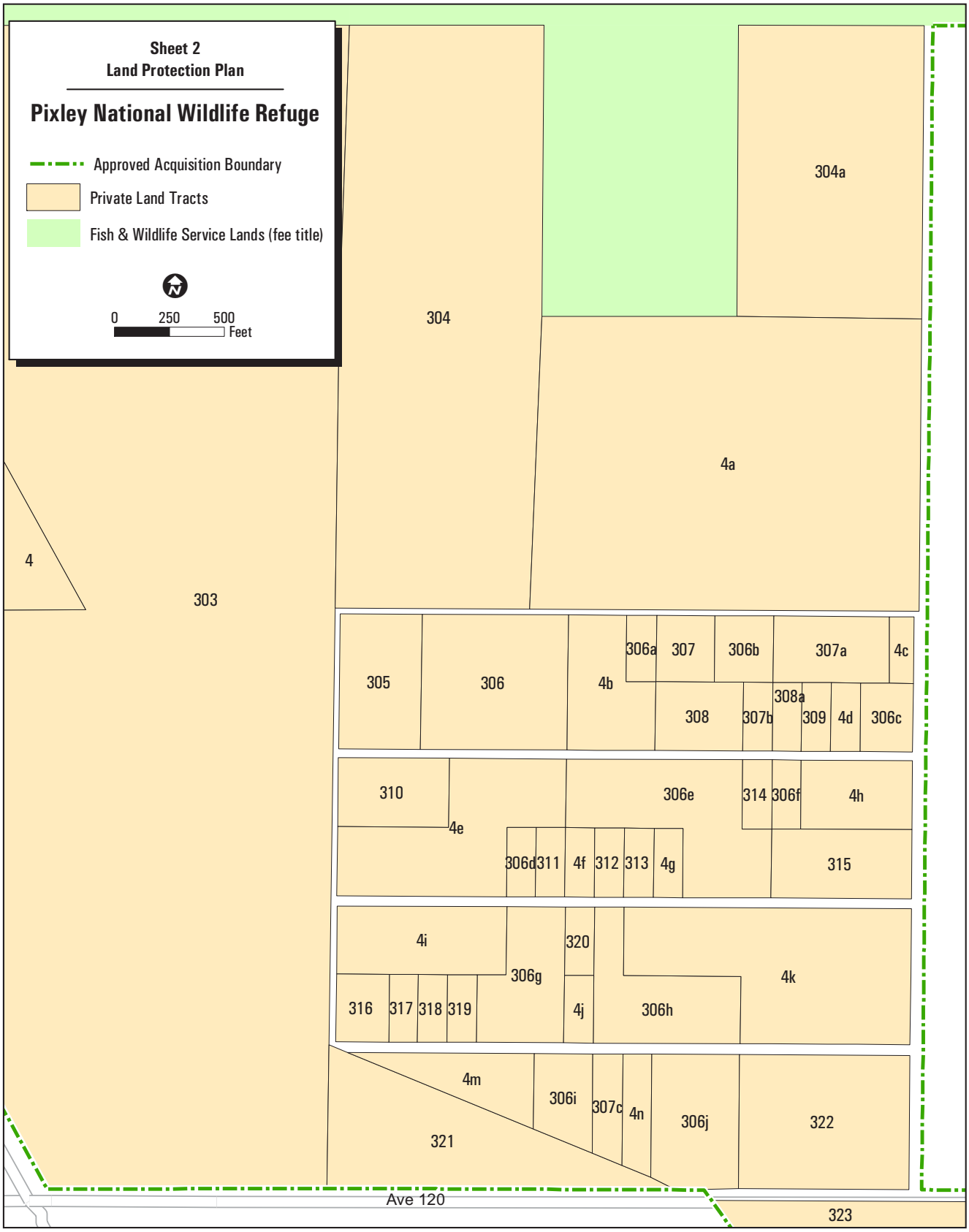
Fee Title Acquisition
The Services acquires land by outright purchase (fee title) when (1) the land's fish and wildlife resources require permanent protection that is not otherwise available, (2) the land is needed for development associated with public use, (3) a pending land use could otherwise harm fish and wildlife resources, or (4) purchased is the most practical and economical way to assemble small tracts into a manageable unit. Fee title acquisition transfers all property rights owned by the landowner, including mineral and water rights, to the Federal government. A fee title interest may be acquired by purchased, donation, exchange, or transfer.

Land Protection Priorities within the Approved Refuge Boundary

Map Sheets 1 through 5 show the tracts within the approved acquisition boundary. The Service has prepared a table (see Table 1) that lists landowners, assessor parcel numbers, acreage and priority for acquisition should the property owner be willing to sell and funding become available. The Service would seek acquisition by fee title or conservation easements of all or part of the lands within the approved Refuge boundary.

Each tract is assigned a priority for land protection/acquisitions varying from high to low priority. High priority is designated with a 1, identifying lands that are native upland habitat and connect existing endangered species habitats. Lowest in priority are lands designated with a 3 within the approved refuge boundary that have been developed for some type of agricultural use such as a dairy, row crops, and orchards.


Sheet 1
Land Protection Plan
Pixley National Wildlife Refuge
Approved Acquisition Boundary
Private Land Tracts
Fish & Wildlife Service Lands (fee title)
0 0.5 1 2
Miles
Ave 152
Ave 144
Ave 128
Ave 120
Ave 112
Ave 104
Ave 96
Ave 88
Ave 72
Ave 68
Ave 64
Ave 56
Rd 64
Rd 72
Rd 80
Rd 88
Rd 96
Rd 104
Rd 112
Rd 120
Rd 40
300
301
302
303
4
5
6
323
324
325
326
Sheet 2
Sheet 3
Sheet 4
Sheet 5
Angiola
Pixley
Alpaugh
Allensworth
Central Valley Hwy
99


Sheet 2
Land Protection Plan
Pixley National Wildlife Refuge
Approved Acquisition Boundary
Private Land Tracts
Fish & Wildlife Service Lands (fee title)
0 250 500
Feet
304
304a
4a
4
303
305
306
4b
306a
307
306b
307a
4c
308
307b
308a
309
4d
306c
310
4e
306e
314
306f
4h
306d
311
4f
312
313
4g
315
4i
320
306g
4k
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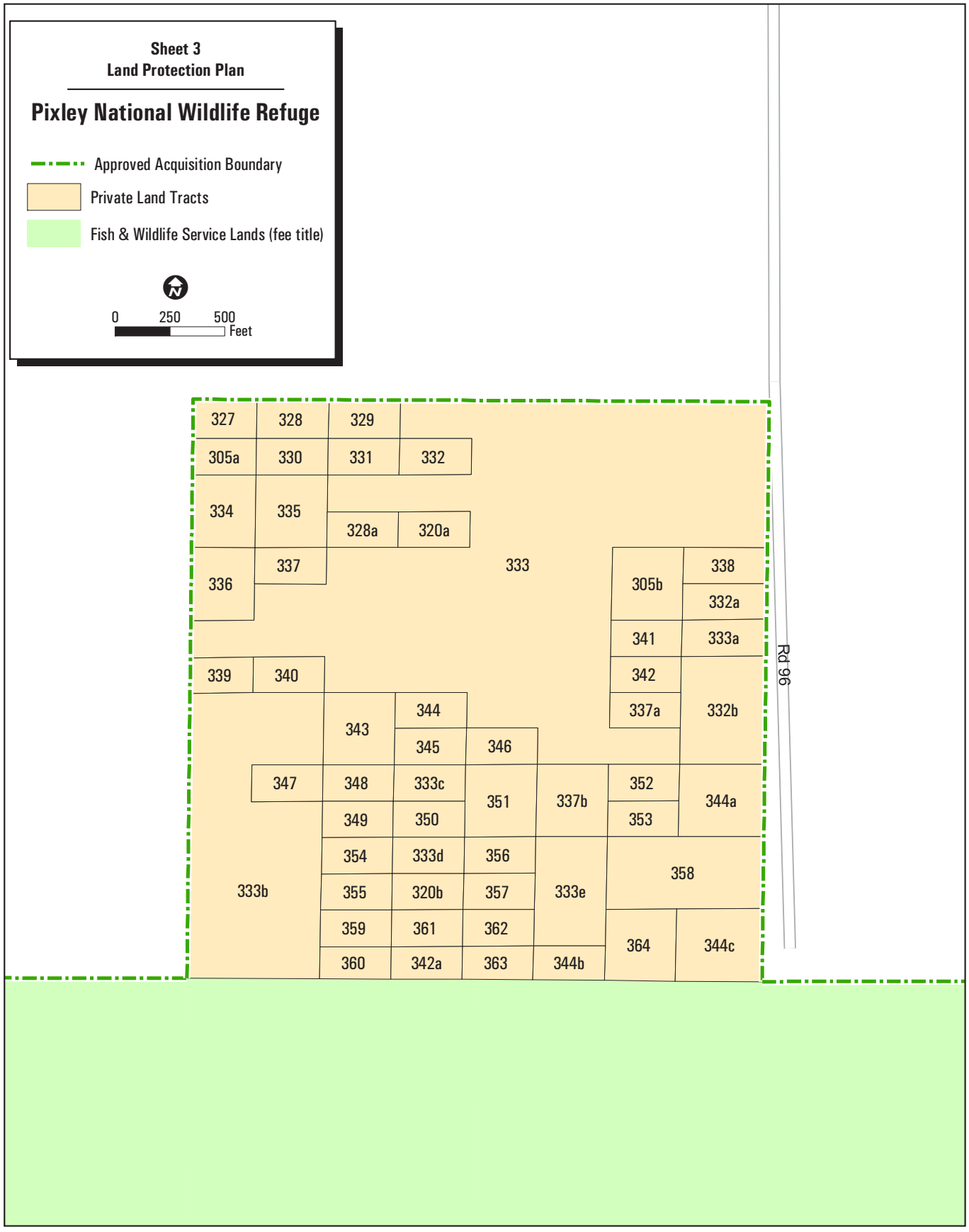
318
319
4j
306h
4m
306i
307c
4n
306j
322
321
Ave 120
323


Sheet 3
Land Protection Plan
Pixley National Wildlife Refuge
Approved Acquisition Boundary
Private Land Tracts
Fish & Wildlife Service Lands (fee title)
N
0
250
500
Feet
327
328
329
305a
330
331
332
334
335
328a
320a
336
337
333
305b
338
332a
341
333a
339
340
342
332b
343
344
337a
345
346
347
348
333c
351
337b
352
344a
349
350
353
354
333d
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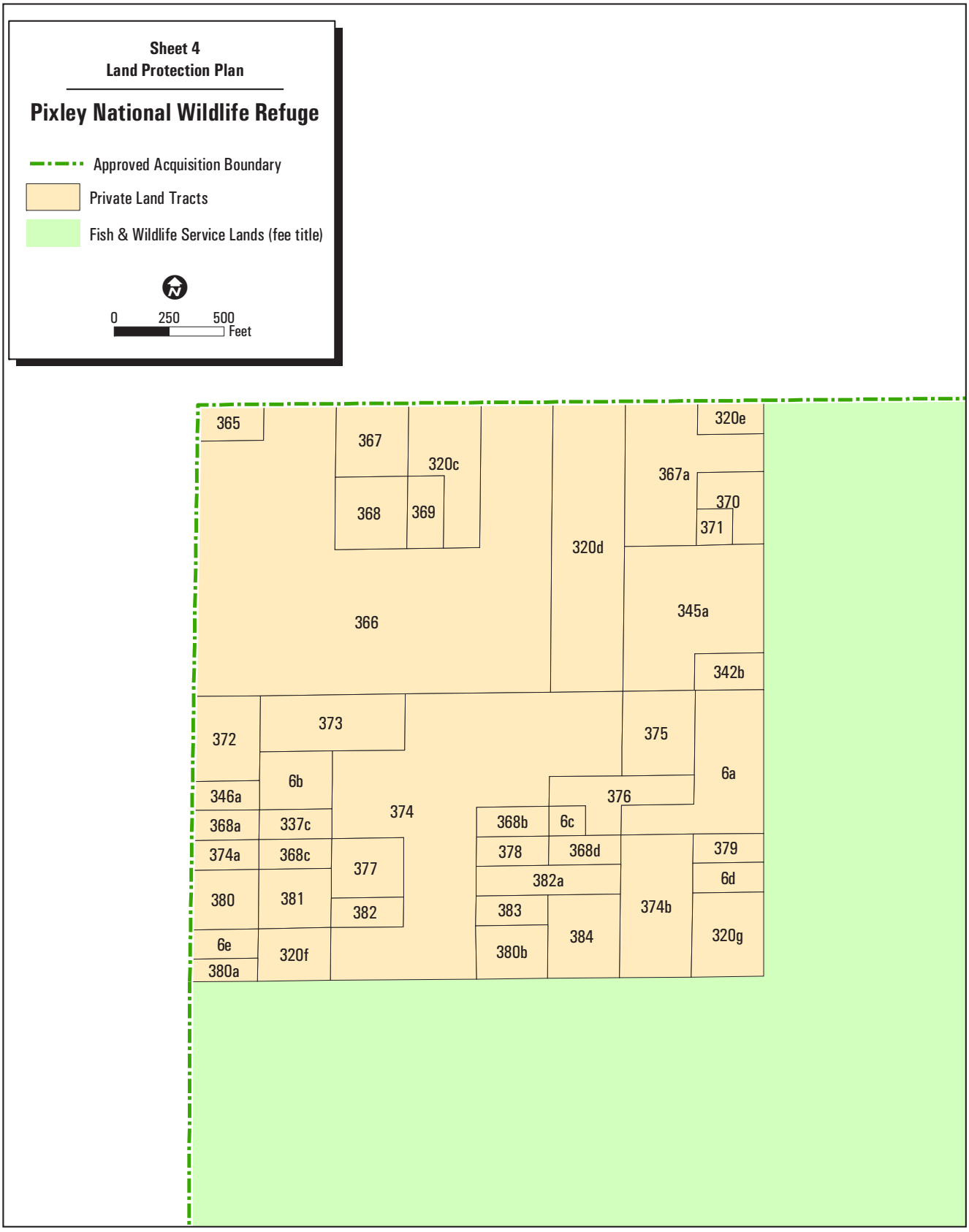
Rd 96


Sheet 4
Land Protection Plan
Pixley National Wildlife Refuge
Approved Acquisition Boundary
Private Land Tracts
Fish & Wildlife Service Lands (fee title)
N
0
250
500
Feet
365
367
320c
368
369
320e
367a
370
371
320d
366
345a
342b
372
373
375
6a
6b
346a
376
368a
337c
374
368b
6c
374a
368c
377
378
368d
379
382a
6d
380
381
382
383
374b
384
320g
6e
320f
380b
380a

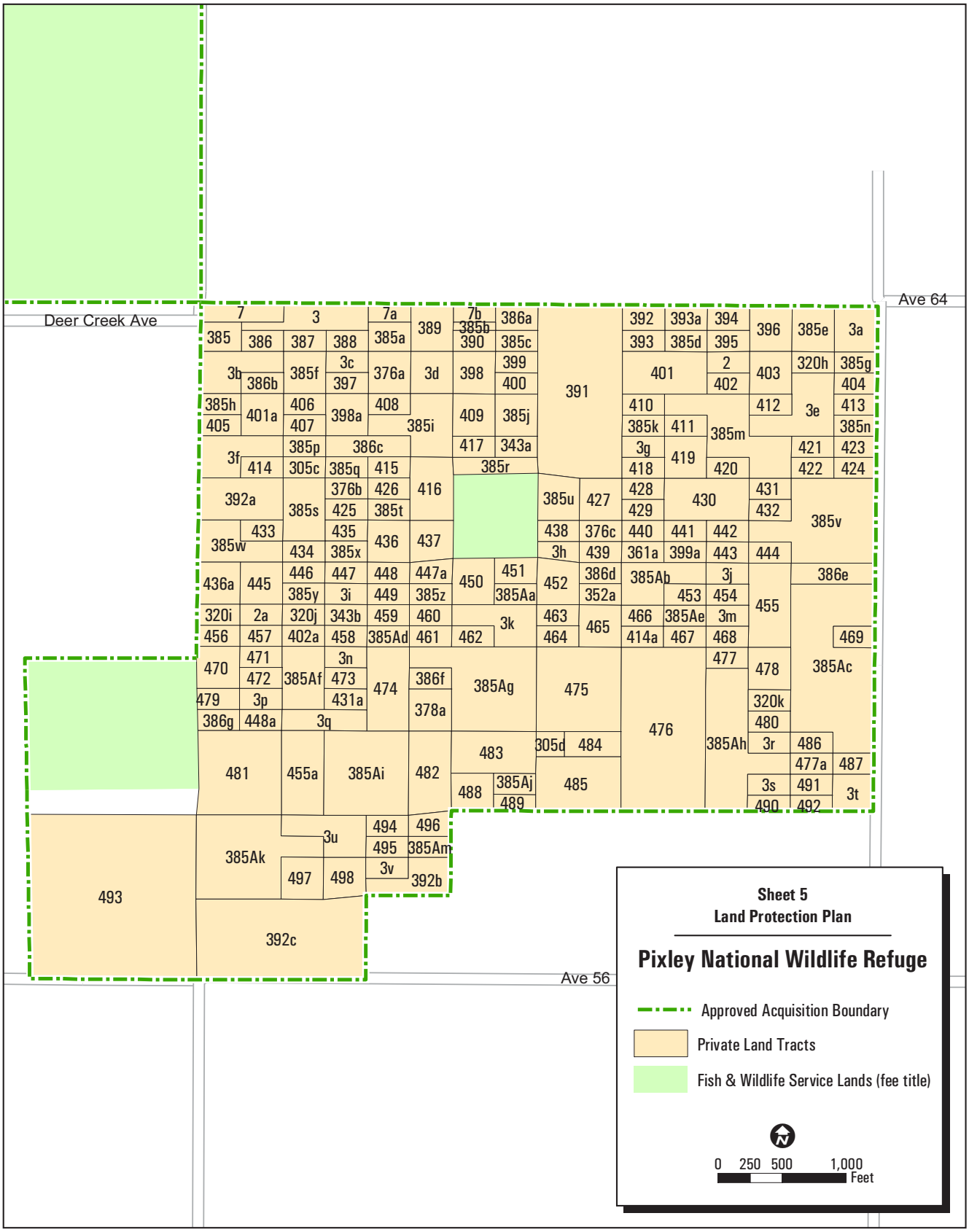

Deer Creek Ave
Ave 64
Ave 56
Sheet 5
Land Protection Plan
Pixley National Wildlife Refuge
Approved Acquisition Boundary
Private Land Tracts
Fish & Wildlife Service Lands (fee title)
N
0 250 500 1,000
Feet

Table 1. Pixley NWR Tracts.

Owner / Tract #	APN #	Acreage	Priority
CALIF STATE OF UNIVERSITY			
2			1
	322-170-003	1.25	
2a			1
	322-050-001	1.25	
TULARE COUNTY OF			
3			1
	322-080-011	1.25	
	322-080-007	0.50	
	322-080-010	1.25	
3a			1
	322-170-008	2.50	
3b			1
	322-080-001	1.25	
	322-080-003	1.25	
	322-080-004	1.25	
3c			1
	322-080-013	1.25	
3d			1
	322-090-001	2.50	
3e			1
	322-170-011	1.25	
	322-180-008	1.25	
	322-180-007	2.50	
3f			1
	322-070-003	2.50	
	322-070-001	1.25	
3g			1
	322-150-008	1.25	
3h			1
	322-140-003	1.25	
3i			1
	322-050-010	1.25	
3j			1
	322-200-004	1.25	
3k			1
	322-120-014	1.25	
	322-120-012	2.50	
3m			1
	322-200-002	1.25	
3n			1
	322-040-012	1.25	
3p			1
	322-040-001	1.25	
3q			1
	322-040-011	1.25	
	322-040-015	1.25	
3r			1
	322-220-005	1.25	
3s			1
	322-220-001	1.25	
3t			1
	322-220-010	2.50	
3u			1
	322-020-008	2.50	
	322-020-004	1.25	

Table 1. Pixley NWR Tracts.

Owner / Tract #	APN #	Acreage	Priority
3v			1
	322-020-011	1.25	
LOWER TULE RIVER IRRIGATION DISTRIC			
4			1
	291-060-020	93.15	
4a			1
	293-030-005	26.66	
	293-030-004	26.70	
4b			1
	293-280-004	1.84	
	293-280-005	1.92	
	293-280-003	1.00	
4c			1
	293-280-016	0.75	
4d			1
	293-280-014	1.00	
4e			1
	293-280-028	1.91	
	293-280-026	1.92	
	293-280-029	5.59	
4f			1
	293-280-032	1.00	
4g			1
	293-280-022	1.00	
4h			1
	293-280-017	3.65	
4i			1
	293-270-003	5.50	
4j			1
	293-270-005	1.00	
4k			1
	293-270-009	9.34	
	293-270-008	1.00	
	293-270-010	1.87	
	293-270-012	1.70	
	293-270-011	1.00	
4m			1
	293-270-018	3.34	
4n			1
	293-270-015	1.69	
ANGIOLA WATER DIST			
5			1
	293-250-011	211.38	
	293-230-001	320.96	
	293-240-003	161.26	
	293-220-007	38.93	
PIXLEY IRRIGATION DISTRICT			
6			1
	313-150-007	158.18	
6a			1
	313-090-023	1.00	
	313-090-022	4.91	
6b			1
	313-090-012	1.00	
	313-090-015	1.00	

Table 1. Pixley NWR Tracts.

Owner / Tract #	APN #	Acreage	Priority
6c			1
	313-090-019	0.50	
6d			1
	313-090-025	1.00	
6e			1
	313-090-005	1.00	
DEER CREEK STORM WATER DIST			
7			1
	322-080-017	1.52	
7a			1
	322-090-004	0.75	
7b			1
	322-090-009	0.75	
BAYOU VISTA FARMS WEST			
300			1
	291-050-018	26.65	
	291-050-020	3.30	
	291-040-008	315.30	
	291-050-024	233.91	
KNEVELBAARD DAIRIES			
301			3
	293-040-035	317.88	
M CURTI & SONS A CALIF CORP			
302			1
	291-050-007	62.22	
LANTINO GEORGE K & MARILYN J (CO-TR			
303			3
	291-060-021	243.39	
BOSMAN DAIRY			
304			1
	293-030-001	26.66	
	293-030-006	26.66	
304a			1
	293-030-003	26.66	
N R L L INC			
305			1
	293-280-001	5.27	
305a			1
	313-190-009	1.25	
305b			1
	313-190-029	2.50	
305c			1
	322-070-012	1.25	
305d			1
	322-010-016	1.00	
TEXAS CO			
306			1
	293-280-002	9.40	
306a			1
	293-280-006	1.00	
306b			1

Table 1. Pixley NWR Tracts.

Owner / Tract #	APN #	Acreage	Priority
	293-280-009	1.85	
306c			1
	293-280-015	1.71	
306d			1
	293-280-027	0.95	
306e			1
	293-280-021	8.68	
306f			1
	293-280-019	1.00	
306g			1
	293-270-004	4.69	
306h			1
	293-270-007	5.66	
306i			1
	293-270-017	2.44	
306j			1
	293-270-014	5.51	
HAURY MARION E (EST OF)			
307			1
	293-280-007	1.84	
307a			1
	293-280-013	3.67	
307b			1
	293-280-010	1.00	
307c			1
	293-270-016	1.50	
KVILHAUG RONALD & CHARLOTTE (CO-TRS			
308			1
	293-280-008	2.87	
308a			1
	293-280-011	1.00	
SARVAK KENNETH E			
309			1
	293-280-012	1.00	
CONCORDIA COLLEGE CORP			
310			1
	293-280-030	3.63	
MC KINNEN MALCOLM A			
311			1
	293-280-031	1.00	
JCH FAMILY LIMITED PTNSHP			
312			1
	293-280-024	1.00	
NOONAN DANIEL T (TR)			
313			1
	293-280-023	1.00	
MAIER MARIE AUBREY (EST OF)			
314			1
	293-280-020	1.00	
CHILDS JAMES C JR			
315			1

Table 1. Pixley NWR Tracts.

Owner / Tract #	APN #	Acreage	Priority
	293-280-018	4.61	
MOLINE WILLIAM G & JOANN M			
316			1
	293-270-001	1.71	
VIERA ANGEL H			
317			1
	293-270-023	1.00	
CRAVEN TED			
318			1
	293-270-022	1.00	
NICHOLSON LILLIAN			
319			1
	293-270-021	1.00	
JOHNSTON DAVID R			
320			1
	293-270-006	1.00	
320a			1
	313-190-021	1.25	
320b			1
	313-180-003	1.25	
320c			1
	313-100-007	3.75	
320d			1
	313-100-009	10.00	
320e			1
	313-100-011	1.25	
320f			1
	313-090-003	2.00	
320g			1
	313-090-026	3.00	
320h			1
	322-170-012	1.25	
320i			1
	322-050-004	1.25	
320j			1
	322-050-014	1.25	
320k			1
	322-210-001	1.25	
WHEAT DAVID B			
321			1
	293-270-019	12.50	
CHIER RICHARD C ET AL			
322			1
	293-270-013	10.85	
WESTRA RICHARD D & MARY			
323			3
	293-260-003	82.91	
	293-260-004	80.00	
	293-010-003	79.32	
PACHECO & ASSOCIATES			
324			1

Table 1. Pixley NWR Tracts.

Owner / Tract #	APN #	Acreage	Priority
	293-010-009	160.17	
	293-010-008	79.30	
WEGER HOWARD O & M JANE (CO-TRS)			
325			1
	293-200-003	60.00	
	293-220-006	122.31	
CORCORAN MOTOR TRANSPORT INC			
326			1
	293-200-004	20.00	
BISHOP MARTHA ELIZABETH			
327			1
	313-190-010	1.25	
BAKER BETTYE C			
328			1
	313-190-011	1.25	
328a			1
	313-190-014	1.25	
MANLOVE WILLIE M			
329			1
	313-190-017	1.25	
MUELLER MARGARET (EST OF)			
330			1
	313-190-012	1.25	
KAPETAN MARC N			
331			1
	313-190-016	1.25	
CURL E D & LILLIE M			
332			1
	313-190-019	1.25	
332a			1
	313-190-024	1.25	
332b			1
	313-180-032	2.50	
	313-190-026	1.25	
HOWARD MARION O			
333			1
	313-190-003	2.50	
	313-190-022	20.00	
	313-190-018	1.25	
	313-190-030	2.50	
	313-180-030	1.25	
	313-180-045	3.66	
	313-190-006	1.25	
	313-190-001	20.00	
333a			1
	313-190-025	1.25	
333b			1
	313-180-012	2.50	
	313-180-044	6.25	
	313-180-009	5.00	
	313-180-011	5.00	

Table 1. Pixley NWR Tracts.

Owner / Tract #	APN #	Acreage	Priority
333c			1
	313-180-020	1.25	
333d			1
	313-180-004	1.25	
333e			1
	313-180-047	3.75	
THE WHEELER TRUST			
334			1
	313-190-008	2.50	
RINGGOLD REGINA			
335			1
	313-190-013	2.50	
BENSON KESIAH			
336			1
	313-190-007	2.50	
BENNETT WILLIS W			
337			1
	313-190-002	1.25	
337a			1
	313-180-031	1.25	
337b			1
	313-180-046	2.50	
337c			1
	313-090-011	1.00	
ATLEY MAE E			
338			1
	313-190-023	1.25	
CHENOWETH DOROTHY M ET AL			
339			1
	313-190-005	1.25	
ALLEN LOUISE H			
340			1
	313-190-004	1.25	
HIRATA AILEEN A			
341			1
	313-190-028	1.25	
ELY WILMA E (TR)			
342			1
	313-190-027	1.25	
342a			1
	313-180-001	1.25	
342b			1
	313-100-015	1.25	
PACIFIC COAST LAND CO LTD			
343			1
	313-180-017	2.50	
343a			1
	322-100-009	1.25	
343b			1
	322-050-011	1.25	

Table 1. Pixley NWR Tracts.

Owner / Tract #	APN #	Acreage	Priority
CALLAN JOHN T			
344			1
	313-180-018	1.25	
344a			1
	313-180-033	2.50	
344b			1
	313-180-037	1.25	
344c			1
	313-180-035	2.50	
DARETTE ALFRED & THELMA			
345			1
	313-180-019	1.25	
345a			1
	313-100-014	8.75	
HARVEY GEORGE C & ETHEL L			
346			1
	313-180-023	1.25	
346a			1
	313-090-013	1.00	
ABILA CRESPIN & HELEN			
347			1
	313-180-013	1.25	
LARSEN NEILS C ET AL			
348			1
	313-180-016	1.25	
BAILEY ROBERT T & PHYLLIDA C (TRS)			
349			1
	313-180-015	1.25	
HERBERT DORIS			
350			1
	313-180-021	1.25	
ATOR MARK L & KATHY D			
351			1
	313-180-022	2.50	
WALDRON ROBERT C JR			
352			1
	313-180-029	1.25	
352a			1
	322-130-006	2.50	
FRASER JOYCIE E			
353			1
	313-180-028	1.25	
WELLS GLEN R			
354			1
	313-180-005	1.25	
MILLER M M TR ET AL			
355			1
	313-180-006	1.25	
SMITH DONNIE L & SANDRA M (CO-TRS)			
356			1

Table 1. Pixley NWR Tracts.

Owner / Tract #	APN #	Acreage	Priority
	313-180-040	1.25	
GRAHAM CHARLOTTE			
357			1
	313-180-041	1.25	
RODENBORN W A ET AL			
358			1
	313-180-034	5.00	
BERTRAM RUDOLPH F JR			
359			1
	313-180-007	1.25	
ASHLOCK ANNA			
360			1
	313-180-008	1.25	
RUIZ REBECA			
361			1
	313-180-002	1.25	
361a			1
	322-140-012	1.25	
TANAKA DEE ANN KEIKO			
362			1
	313-180-042	1.25	
WRIGHT ED			
363			1
	313-180-043	1.25	
KIDD EDYTHE (EST OF)			
364			1
	313-180-036	2.50	
PARKER RANDALL J & AUDREY			
365			1
	313-100-003	1.25	
THE SAMUEL A WHITE & ESTHER M WHITE			
366			1
	313-100-001	25.00	
	313-100-002	8.75	
	313-100-008	5.00	
GONZALEZ PEDRO & ROGELIA			
367			1
	313-100-004	2.50	
367a			1
	313-100-010	6.25	
BETTENCOURT MARY L			
368			1
	313-100-005	2.50	
368a			1
	313-090-010	1.00	
368b			1
	313-090-018	1.00	
368c			1
	313-090-008	1.00	
368d			1

Table 1. Pixley NWR Tracts.

Owner / Tract #	APN #	Acreage	Priority
	313-090-030	1.00	
VELASCO RICHARD & JANET			
369			1
	313-100-006	1.25	
RAMSEY DONALD F (TR)			
370			1
	313-100-012	2.00	
CALLAN THOMAS J & GLADYS ANN (TR)			
371			1
	313-100-013	0.62	
MILLER IRVIN J & AFTON F (TRS)			
372			1
	313-090-014	2.92	
HUBER LARRY D			
373			1
	313-090-016	2.82	
WHITE SAM A & ESTHER M			
374			1
	313-090-035	2.00	
	313-090-034	19.73	
374a			1
	313-090-009	1.00	
374b			1
	313-090-037	4.00	
	313-090-036	1.00	
TOROSIAN DERON P & ISABEL			
375			1
	313-090-021	2.91	
OLIVER LEO			
376			1
	313-090-020	2.50	
376a			1
	322-090-002	2.50	
376b			1
	322-060-007	1.25	
376c			1
	322-140-001	1.25	
HAYES GLENNA S (TR)			
377			1
	313-090-001	2.00	
ALMA INVESTMENT COMPANY			
378			1
	313-090-031	1.00	
378a			1
	322-010-008	2.50	
CAREY HELEN J (TR)			
379			1
	313-090-024	1.00	
MC FARLANE CLIFFORD S			
380			1

Table 1. Pixley NWR Tracts.

Owner / Tract #	APN #	Acreage	Priority
	313-090-006	2.00	
380a			1
	313-090-004	1.00	
380b			1
	313-090-033	2.00	
RIPPY LOIS N			
381			1
	313-090-007	2.00	
COSTA ANDREW & RENE			
382			1
	313-090-002	1.00	
382a			1
	313-090-029	2.00	
THOMAS EVANGELINE			
383			1
	313-090-032	1.00	
SCHMOKER LAVON ELBERT & NYO ROMA (T			
384			1
	313-090-028	3.00	
BECK NANCY I			
385			1
	322-080-005	1.75	
385a			1
	322-090-003	1.75	
385Aa			1
	322-120-011	1.25	
385Ab			1
	322-130-014	3.75	
385Ac			1
	322-220-008	1.25	
	322-210-007	10.00	
	322-200-014	1.25	
	322-200-013	5.00	
385Ad			1
	322-120-003	1.25	
385Ae			1
	322-130-010	1.25	
385Af			1
	322-040-016	3.75	
385Ag			1
	322-010-020	11.25	
385Ah			1
	322-210-004	1.25	
	322-210-003	2.50	
	322-220-013	6.25	
385Ai			1
	322-030-003	5.00	
	322-010-006	5.00	
385Aj			1
	322-010-002	1.25	
385Ak			1
	322-020-023	11.25	
385Am			1

Table 1. Pixley NWR Tracts.

Owner / Tract #	APN #	Acreage	Priority
	322-020-022	26.25	
385b			1
	322-090-008	0.50	
385c			1
	322-090-011	1.25	
385d			1
	322-160-005	1.25	
385e			1
	322-170-007	2.50	
385f			1
	322-080-015	2.50	
385g			1
	322-170-009	1.25	
385h			1
	322-070-005	1.25	
385i			1
	322-100-012	5.00	
385j			1
	322-100-008	2.50	
385k			1
	322-150-002	1.25	
385m			1
	322-150-004	1.25	
	322-180-015	6.25	
385n			1
	322-180-010	1.25	
385p			1
	322-070-013	1.25	
385q			1
	322-070-011	1.25	
385r			1
	322-100-010	2.50	
385s			1
	322-060-014	3.75	
385t			1
	322-110-003	1.25	
385u			1
	322-140-005	2.50	
385v			1
	322-190-009	11.25	
385w			1
	322-060-013	3.75	
385x			1
	322-060-010	1.25	
385y			1
	322-050-007	1.25	
385z			1
	322-120-008	1.25	
DE MONTE LEO & VIVIAN (TR)			
386			1
	322-080-008	1.25	
386a			1
	322-090-010	1.25	
386b			1
	322-080-002	1.25	
386c			1

Table 1. Pixley NWR Tracts.

Owner / Tract #	APN #	Acreage	Priority
	322-070-010	1.25	
	322-100-004	1.25	
386d			1
	322-130-005	1.25	
386e			1
	322-200-007	2.50	
386f			1
	322-010-009	1.25	
386g			1
	322-040-003	1.25	
DUNLAP JOSEPH PHILIP			
387			1
	322-080-009	1.25	
UPTEGROVE JOHN			
388			1
	322-080-012	1.25	
ALFORD MARTHA JUNE			
389			1
	322-090-015	2.50	
CHAMBERLAIN ORA N			
390			1
	322-090-007	1.25	
BIMAT ROBERT E			
391			1
	322-160-001	10.00	
	322-150-001	10.00	
COCHRAN DONALD W & IVA L			
392			1
	322-160-003	1.25	
392a			1
	322-060-004	5.00	
392b			1
	322-020-013	2.50	
	322-020-012	1.25	
392c			1
	322-020-018	5.00	
	322-020-001	10.00	
	322-020-019	2.50	
	322-020-020	2.50	
KIENTZ FRANCIS J & GENEVIEVE B			
393			1
	322-160-002	1.25	
393a			1
	322-160-004	1.25	
BERGER IRVING & ADELE ET AL			
394			1
	322-170-005	1.25	
EELLS ERNEST ROBERT			
395			1
	322-170-004	1.25	
RUNDQUIST ARLENE (HEIR JAKE MODEL)			

Table 1. Pixley NWR Tracts.

Owner / Tract #	APN #	Acreage	Priority
396			1
	322-170-006	2.50	
PALMER BEN H			
397			1
	322-080-014	1.25	
LIEBEL LEO W SR (TR)			
398			1
	322-090-014	2.50	
398a			1
	322-070-009	2.50	
JOHNSON ROBERT L & JUDIE B			
399			1
	322-090-012	1.25	
399a			1
	322-140-011	1.25	
MAYER DIETER			
400			1
	322-090-013	1.25	
WALKENHORST JOHN W & RENEE			
401			1
	322-160-006	5.00	
401a			1
	322-070-006	2.50	
CH-FIRST BAPTIST CHURCH			
402			1
	322-170-002	1.25	
402a			1
	322-050-013	1.25	
DARETTE ALFRED & THELMA			
403			1
	322-170-001	2.50	
HAMBURGER VICTOR & ESTHER			
404			1
	322-170-010	1.25	
JONES WILHELMINA B			
405			1
	322-070-004	1.25	
EMERSON JON S			
406			1
	322-070-008	1.25	
DRIGGERS MICHAEL A & MARY			
407			1
	322-070-007	1.25	
ARMSTRONG NETTIE			
408			1
	322-100-005	1.25	
SMITH MABEL WREN (EST OF)			
409			1
	322-100-007	2.50	

Table 1. Pixley NWR Tracts.

Owner / Tract #	APN #	Acreage	Priority
WOOD JAMES D			
410			1
	322-150-003	1.25	
DIX THOMAS H			
411			1
	322-150-005	1.25	
O'BRIEN LINDA KAY			
412			1
	322-180-006	1.25	
MOORE OSCAR W (TR)			
413			1
	322-180-009	1.25	
STALLINGS HAROLD L SR & ELENORA K			
414			1
	322-070-002	1.25	
414a			1
	322-130-012	1.25	
FINOCHIO ANTHONY & MAXINE C			
415			1
	322-100-003	1.25	
AAGAARD PAUL M & MARJORIE A (TRS)			
416			1
	322-100-002	1.25	
	322-100-005	1.25	
POWELL KATHLEEN C			
417			1
	322-100-011	1.25	
ALSING RUDI A			
418			1
	322-150-007	1.25	
CAVETTE SUSAN (EST OF)			
419			1
	322-150-006	2.50	
WERNLI EMIL W			
420			1
	322-180-003	1.25	
JONES JAMES H & ISABELLE			
421			1
	322-180-014	1.25	
TURNER CHARLES A (TR)			
422			1
	322-180-013	1.25	
CLEMENS CHARLES E			
423			1
	322-180-011	1.25	
DAWSON WILLIE T			
424			1
	322-180-012	1.25	

Table 1. Pixley NWR Tracts.

Owner / Tract #	APN #	Acreage	Priority
KOOP VICTORY MARIE			
425			1
	322-060-008	1.25	
DUNLAP JOSEPH P ET AL			
426			1
	322-110-004	1.25	
ELMORE JOHN E JR (TR)			
427			1
	322-140-006	2.50	
DYER NELL & GEO (ESTS OF)			
428			1
	322-140-008	1.25	
MC DOUGALL FLORENCE L			
429			1
	322-140-007	1.25	
ABERNATHY DAVID P & NANCY S (TRS)			
430			1
	322-140-009	2.50	
	322-190-005	2.50	
WALTON KRIS J			
431			1
	322-190-007	1.25	
431a			1
	322-040-014	1.25	
CH-HEBREW EVANGELIZATION SOCIETY IN			
432			1
	322-190-006	1.25	
MALLET KATHERINE A			
433			1
	322-060-001	1.25	
SPRINGER LUCY E			
434			1
	322-060-011	1.25	
POPE F W			
435			1
	322-060-009	1.25	
GODKIN CECIL E & BEATRICE			
436			1
	322-110-002	2.50	
436a			1
	322-050-005	2.50	
SWARTZ A			
437			1
	322-110-001	2.50	
CORK MARY L			
438			1
	322-140-004	1.25	
COVEY W L DR			
439			1

Table 1. Pixley NWR Tracts.

Owner / Tract #	APN #	Acreage	Priority
	322-140-002	1.25	
KOONS WILMA R			
440			1
	322-140-013	1.25	
BAHN WILLIAM E			
441			1
	322-140-010	1.25	
WARD EMMA K			
442			1
	322-190-004	1.25	
WELTY CHRISTOPHER D			
443			1
	322-190-003	1.25	
AESPURO RICARDO LUIS			
444			1
	322-190-002	1.25	
BRIDGES JAN MICHAEL (TR)			
445			1
	322-050-006	2.50	
KROSSCHELL THOMAS D			
446			1
	322-050-008	1.25	
BENTON MAX D & JUDITH L			
447			1
	322-050-009	1.25	
447a			1
	322-120-007	1.25	
MANZ KATHERINE J			
448			1
	322-120-006	1.25	
448a			1
	322-040-002	1.25	
SATCHELL NORMAN H & LOIS A (TRS)			
449			1
	322-120-005	1.25	
TUTEUR THERESA			
450			1
	322-120-009	2.50	
BARNHART THOMAS M & L S			
451			1
	322-120-010	1.25	
EASTER SEALS SOUTHERN CALIFORNIA IN			
452			1
	322-130-004	2.50	
BREWER CLAUD C & LILLIE M			
453			1
	322-130-009	1.25	
THOMPSON M IRENE & SARAH L			

Table 1. Pixley NWR Tracts.

Owner / Tract #	APN #	Acreage	Priority
454			1
	322-200-003	1.25	
KENDALL MARGARET			
455			1
	322-200-005	5.00	
455a			1
	322-030-002	5.00	
HERRMANN RUSSELL			
456			1
	322-050-003	1.25	
WALKER RUSSELL F & MARY			
457			1
	322-050-002	1.25	
VAN SICKLE GARFIELD			
458			1
	322-050-012	1.25	
FISCHER BESSIE			
459			1
	322-120-004	1.25	
PETERS HAROLD			
460			1
	322-120-001	1.25	
DREW ANNIE ET AL			
461			1
	322-120-002	1.25	
JENKINS EVA E			
462			1
	322-120-013	1.25	
WELLS RUTH D			
463			1
	322-130-003	1.25	
SMALDINO LOUIS & MARGARET I (TRS)			
464			1
	322-130-002	1.25	
ROBERTS JACK D			
465			1
	322-130-001	2.50	
GRANT JOHN			
466			1
	322-130-013	1.25	
MONDRAGON JOAN M			
467			1
	322-130-011	1.25	
HORTON BARBARA C			
468			1
	322-200-001	1.25	
GREIN GORDON M			
469			1

Table 1. Pixley NWR Tracts.

Owner / Tract #	APN #	Acreage	Priority
	322-200-010	1.25	
KISER STEVEN WILLIAM			
470			1
	322-040-005	2.50	
WANDREI EARL L			
471			1
	322-040-007	1.25	
AHMED IQBAL			
472			1
	322-040-006	1.25	
DE LORETO EDWARD & JILL (TRS)			
473			1
	322-040-013	1.25	
LINDGREN EDNA MAE (TR)			
474			1
	322-010-007	5.00	
FREDRICKSON ADA B (SUCCESSOR TRUSTE			
475			1
	322-010-012	10.00	
BARBIAN WILBUR L & VIRGINIA L (TR B			
476			1
	322-010-014	10.00	
	322-010-013	10.00	
GREIN GEORGE ARTHUR			
477			1
	322-210-005	1.25	
477a			1
	322-220-007	1.25	
COWAN RALPH & RUBY			
478			1
	322-210-006	2.50	
CONNER ROBERT LOUIS			
479			1
	322-040-004	1.25	
HARPER ALTA			
480			1
	322-210-002	1.25	
DUNCAN JUNE			
481			1
	322-030-001	10.00	
MOORE TOM			
482			1
	322-010-005	5.00	
MACK C E			
483			1
	322-010-001	5.00	
EAQUINTA ANN (TR)			
484			1

Table 1. Pixley NWR Tracts.

Owner / Tract #	APN #	Acreage	Priority
	322-010-018	2.00	
BUS & PROF EX INC SALT LAKE CI			
485			1
	322-010-019	7.00	
KELLER & HOLT (TRS)			
486			1
	322-220-006	1.25	
MC LAIN GARY			
487			1
	322-220-009	1.25	
HANNAKER ETHEL B			
488			1
	322-010-004	2.50	
HORN FRED W & MARY L			
489			1
	322-010-003	1.25	
PICHLER AVANELL			
490			1
	322-220-002	1.25	
CRIDER ELMER GORDON			
491			1
	322-220-012	1.25	
KALLSEM MAVIS CORKERY			
492			1
	322-220-011	1.25	
RAMIREZ JOSE & MERCEDES			
493			1
	322-240-006	40.00	
NEAT ANNA			
494			1
	322-020-009	1.25	
NEWHOUSE ROBERT M (TR)			
495			1
	322-020-010	1.25	
GUILFORD ELSIE H			
496			1
	322-020-015	1.25	
VAN ELSWYK EVELYN BECK			
497			1
	322-020-024	2.50	
ALKURDI MOHAMED & DIANE			
498			1
	322-020-007	2.50	

Appendix K.
Fire Management Plan

The Department of the Interior (DOI) fire management policy requires that all refuges with vegetation that can sustain fire must have a Fire Management Plan that details fire management guidelines for operational procedures and values to be protected/enhanced. The Fire Management Plan (FMP) for the Kern NWRC will provide guidance on preparedness, prescribed fire, wildland fire, and prevention. Values to be considered in the Fire Management Plan include protection of Refuge resources and neighboring private properties, effects of burning on refuge habitats/biota, and firefighter safety. Refuge resources include properties, structures, cultural resources, trust species including endangered, threatened, and species of special concern, and their associated habitats. The Fire Management Plan will be reviewed periodically to ensure that the fire program is conducted in accordance and evolves with the U.S. Fish and Wildlife Service (USFWS) mission and the Kern NWRC's goals and objectives.

When approved, this document will become the Kern National Wildlife Refuge Complex's Fire Management Plan. Major components include:

- Updated policy for prescribed fires at the Kern National Wildlife Refuge Complex (NWRC).
- Implementation of Complex objectives identified in the 1984 Master Plan and Draft Comprehensive Conservation Plan.
- Format changes under the direction of Fire Management Handbook (Release Date 6/1/00).

This plan is written to provide guidelines for appropriate suppression and prescribed fire programs at the Kern NWRC, which includes the Kern and Pixley National Wildlife Refuges. Prescribed fire may be used to reduce fuels, restore the natural processes and vitality of ecosystems, improve wildlife habitat, remove or reduce non-native species and noxious weeds and /or conduct research.

This Fire Management Plan addresses the use of prescribed fire to manage wetland vegetation in seasonal marshes and moist soil wetlands. Prescribed fire will not occur in upland habitats used by threatened and endangered species and therefore is not addressed in this plan.

Wildland fires that may threaten or occur in upland habitats will be contained/controlled from existing roads and levees. New firebreaks will not be created through upland habitat.

There are no year-round fire-funded personnel located at Kern NWRC. The Zone Fire Management Officer, located at San Luis NWRC, provides fire management oversight for the Complex. A seasonal engine crew based at Kern NWR is funded cooperatively through the Service and the Bureau of Land Management (BLM). Initial attack operations may be conducted in cooperation with the Lost Hills Fire Station, Kern County Fire Department, Tulare County Fire Department, and Bakersfield BLM.

Copies of the plan are available for review at the Kern National Wildlife Refuge Complex, 10811 Corcoran Road, Delano, California, 93215.