Appendix A: Acronyms and Abbreviations

Table A-1. Acronyms and abbreviations used in this Integrated Natural Resources Management Plan.

Acronym/Abbreviation	Definition
°C	degree(s) Celsius
°F	degree(s) Fahrenheit
AICUZ	Air Installation Compatible Use Zone
AML	Appropriate Management Level
AMSL	above mean sea level
AOC	Area of Concern
ATCAA	Air Traffic Control Assigned Airspace
AUM	Animal Unit Month
BASH	Bird/Animal Aircraft Strike Hazard
BEAP	Base Exterior Architecture Plan
BLM	Bureau of Land Management
BMP	Best Management Practice
BO	Biological Opinion
C3	Cool Season Plants
C4	Warm Season Plants
CAA	Clean Air Act
Cal-IPC	California Invasive Plant Council
CalPIF	California Partners in Flight
CBM	Coordinated Bird Monitoring
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CDPA	California Desert Protection Act
CFR	Code of Federal Regulations
CLUMP	Comprehensive Land Use Management Plan
CNDDB	California Natural Diversity Database
CNIC	Commander, Navy Installations Command
CNO	Chief of Naval Operations
CNPS	California Native Plant Society
CO	Commanding Officer
CWA	Clean Water Act
DE	direct energy
DERP	Defense Environmental Restoration Program
DoD	U.S. Department of Defense
DoDI	U.S. Department of Defense Instruction
DTHMA	Desert Tortoise Habitat Management Area
DWMA	Desert Wildlife Management Area
EA	Environmental Assessment

Acronym/Abbreviation	Definition
EIS	Environmental Impact Statement
EMD	Environmental Management Division
EMS	Environmental Management Systems
ENSO	El Nino Southern Oscillation
EO	Executive Order
ERL	Environmental Readiness Level
ESA	Endangered Species Act
ESTCP	Environmental Security Technology Certification Program
EW	Electronic Warfare
F&ES	Fire and Emergency Services
FEMA	Federal Emergency Management Agency
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act of 1972
FMP	Fire Management Plan
ft^2	foot/feet
GFDL	Geophysical Fluid Dynamics Laboratory
GHG	greenhouse gas
GIS	Geographic Information System
GPS	Global Positioning System
GTT	Ground Troop Training
INRMP	Integrated Natural Resources Management Plan
IPMP	Integrated Pest Management Plan
IR	Installation Restoration
IRP	Installation Restoration Program
IWV	Indian Wells Valley
KGRA	Known Geothermal Resource Area
km	kilometer(s)
km^2	square kilometer(s)
LCM	Lacey-Cactus-McCloud Allotment
LEED	Leadership in Energy and Environmental Design
LID	Low Impact Development
m	meter(s)
MBTA	Migratory Bird Treaty Act
MCPA	2-Methyl-4-Chlorophenoxyacetic Acid
MDEP	Mojave Desert Ecosystem Program
mi^2	square mile(s)
MMRP	Military Munitions Response Program
MOA	Memoranda of Agreement
MOA	Military Operations Area
MOU	Memorandum of Understanding
MSL	mean sea level
MW	megawatt(s)
MWR	Morale, Welfare and Recreation
NABCI	North American Bird Conservation Initiative
NAVAIR	Naval Air Systems Command
NAVFAC	Naval Facilities Engineering Command

Acronym/Abbreviation	Definition
Navy	U.S. Department of the Navy
NAWCWD	Naval Air Warfare Center Weapons Division
NAWS-CL	Naval Air Weapons Station China Lake
NDAA	National Defense Authorization Act
NEPA	National Environmental Policy Act
NFSC	Northwest Fisheries Science Center
NOTS	Naval Ordnance Test Station
NPS	National Park Service
NTC	National Training Center
OPNAVINST	Naval Operations Instruction
ORV	off-road-vehicle
OSD	Office of the Secretary of Defense
PARC	Partners in Amphibian and Reptile Conservation
PCM	Parallel Climate Change
PDO	Pacific Decadal Oscillation
PEP	Propellant, Explosive and Pyrotechnic
PIF	Partners in Flight
PL	Public Law
ppm	parts per million
QU	Quail Unlimited
R&D	Research and Development
RA	Restricted Area
RC&D	Resource Conservation and Development
RDAT&E	Research, Development, Acquisition, Testing and Evaluation
RMP	Range Management Plan
SERDP	Strategic Environmental Research and Development Program
STATSGO	State Soil Geographic Database
T&E	Testing and Evaluation
UAS	unmanned aerial system
UC	University of California
USC	U.S. Code
USDA	U.S. Department of Agriculture
USDI	U.S. Department of the Interior
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Service
WAP	Wildlife Action Plan
WFMP	Wildland Fire Management Plan
WHBMP	Wild Horse and Burro Management Plan

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Appendix B: Laws, Guidance, and Regulations Affecting Natural and Cultural Resources

B.1 Overview of Government Regulatory Context of Natural Resources Management

Below is a detailed listing of the government regulatory context of natural resources management. A detailed discussion of regulations and Navy instructions regarding the Sikes Act, Public Law (PL) 86-797 (16 U.S. Code [USC] §§ 670 - 670f) (as amended), U.S. Department of Defense (DoD) Instruction (DoDI) 4715.03, Naval Operations Instruction (OPNAVINST) 5090.1C (30 October 2007), and Naval Facilities Engineering Command (NAVFAC) P-73 Volume II are discussed in this section. Additionally, please refer to this section for a detailed discussion of laws/regulations regarding natural and cultural resources, including, but not limited to the Endangered Species Act (ESA), Migratory Bird Treaty Act (MBTA), DoD Migratory Bird Rule and Guidance, National Environmental Policy Act (NEPA) of 1969, PL 91-190 (42 USC §§ 4321-4370D), and the National Historic Preservation Act. See Table B-1 for a list of natural and cultural resource laws, regulations, and guidance and their expected influence on natural resources management at Naval Air Weapons Station China Lake (NAWS-CL).

This Integrated Natural Resources Management Plan (INRMP) supports the Station's compliance with federal laws, such as those related to environmental documentation, wetlands, endangered species, and land and wildlife management. The purpose of this section is to provide an overview of the most influential regulations and Navy guidance that can pertain to all types of projects occurring on NAWS-CL.

Navy facilities are subject to numerous regulations affecting use and management of the natural resources, including federal laws, executive orders (EOs), and operational Navy instructions. The most important federal laws that affect management of natural resources on NAWS-CL are summarized below. Natural resources consultation requirements, including any current or planned consultations and consistency with ESA Recovery Plans, are discussed in Chapters 4 and 5.

Table B-1. Natural and cultural resources laws, regulations and guidance and their expected influence on natural resources management at Naval Air Weapons Station China Lake.

Law or Regulation	Influence		
	Direct	Indirect	Not Applicable
Abandoned Shipwreck Act of 1987, PL 100-298 (43 USC §§ 2101 - 2106)			X
American Indian Religious Freedom Act of 1978, PL 95-341, as amended (42 USC §§ 1996 - 1996a)	X		
Anadromous Fish Conservation Act of 1965, as amended (16 USC §§ 757a - 757f)			X
Antiquities Act of 1906, PL 59-209 (16 USC §§ 431 - 433)	X		
Archaeological and Historic Resources Management (DoD Directive 4710-1)	X		

Law or Regulation	Influence		
	Direct	Indirect	Not Applicable
Archaeological and Historic Preservation Act (Moss-Bennett Act) of 1974, PL 86-532 (16 USC §§ 469 - 469c)	X		
Bald and Golden Eagle Protection Act of 1940, 54 Statute 251, as amended (16 USC §§ 668 - 668d)	X		
Archaeological Resources Protection Act of 1979, PL 96-95 (16 USC §§ 470aa - 470mm)	X		
Chapter 5 of Title 32, USC			
Clean Air Act of 1955, 69 Statute 322, as amended (42 USC §§ 7401 - 7671q)	X		
Clean Water Act (Federal Water Pollution Control Act) of 1972, PL 92-500, as amended (33 USC §§ 1251-1387)	X		
Coastal Zone Management Act of 1972, PL 92-583 (16 USC §§ 1451 - 1465)			X
Curation of Federally Owned and Administered Archaeological Collections (36 Code of Federal Regulations [CFR] § 79)	X		
Determination of Eligibility for Inclusion in the National Register of Historic Places (36 CFR § 63)	X		
DoDI 4715.3, Environmental Conservation Program, May 3, 1996 (hereby cancelled)			
DoDI 4715.5, Management of Environmental Compliance at Overseas Installations, April 22, 1996			
DoDI 4715.6, Environmental Compliance, April 24, 1996			
DoDI 4715.10, Environmental Education, Training and Career Development, April 24, 1996			
DoDI 1100.21, Voluntary Services in the Department of Defense, March 11, 2002			
DoD Directive 3200.15, Sustainment of Ranges and Operating Areas, November 21, 2003			
DoD Directive 5134.01, Under Secretary of Defense for Acquisition, Technology, and Logistics, December 9, 2005			
DoD Directive 4715.1E, Environment, Safety, and Occupational Health, March 19, 2005			
DoDI 6055.06, DoD Fire and Emergency Services Program, December 21, 2006			
DoDI 4710.02, DoD Interactions with Federally-Recognized Tribes, September 14, 2006			
DoD 4715.05-G, Overseas Environmental Baseline Guidance Document, May 1, 2007			
DoDI 4150.07, DoD Pest Management Program, May 29, 2008			
DoD Financial Management Regulation 7000.14-R, current edition			
DoDI 6055.06, DoD Fire and Emergency Services Program, December 21, 2006			
Emergency Wetlands Resources Act of 1986, PL 99-645, as amended (16 USC §§ 3901 - 3932)		X	
Endangered Species Act of 1973, PL 93-205, (16 USC §§ 1531 - 1534)	X		
Environmental Protection and Enhancement: Subpart H Historic Preservation (32 CFR § 650)			
Environmental Protection Agency Memorandum, Interim Air Quality Policy on Wildland and Prescribed Fires, April 23, 1998			
EO 11593, Protection and Enhancement of the Cultural Environment, May 13, 1971 (36 Federal Register 8921)	X		
EO 11514, Protection and Enhancement of Environmental Quality, March 7, 1970 (35 Federal Register [FR] 4247), as amended by EOs 11541 and 11991		X	
EO 11644, Use of Off-Road Vehicles on Public Lands, February 8, 1972 (37 FR 2877), as amended by EO 12608		X	
EO 11988, Floodplain Management, May 24, 1977 (42 FR 26951) as amended by EO 12148		X	
EO 11990, Protection of Wetlands, May 24, 1977 (42 FR 26961), as amended by EO 12608	X		
EO 12114, Environmental Effects Abroad of Major Federal Actions, January 4, 1979 (44 FR 1957)			X
EO 12915, Federal Implementation of the North American Agreement on Environmental Cooperation May 13, 1994			
EO 12962, Recreational Fisheries, June 7, 1995 (60 FR 30769)			
EO 13007, Indian Sacred Sites May 29, 1996 (61 FR 26771)	X		
EO 13089, Coral Reef Protection, June 11, 1998			
EO 13112, Invasive Species, February 3, 1999 (64 FR 6183), as amended	X		
EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, January 10, 2001			
EO 13423, Strengthening Federal Environmental, Energy, and Transportation Management, January 24, 2007			

Law or Regulation	Influence		
	Direct	Indirect	Not Applicable
EO 13514, Federal Leadership in Environmental, Energy, and Economic Performance, October 8, 2009			
Erosion Protection Act, PL 86-645, as amended (33 USC §§ 426 - 426-3)	X		
Estuary Protection Act of 1968, PL 90-454 (16 USC §§ 1221 - 1226)			X
Farmland Protection Policy Act of 1981, PL 97-98, as amended (7 USC §§ 4201 - 4209)			X
Federal Cave Resources Protection Act of 1988, PL 100-691, as amended (16 USC §§ 4301 - 4310)		X	
Federal Insecticide, Fungicide and Rodenticide Act, PL 92-516, as amended (7 USC §§ 136 - 136y)	X		
Federal Land Policy and Management Act of 1976, PL 94-579, as amended (43USC §§1701 - 1785)			X
Federal Noxious Weed Act of 1974, PL 93-629, as amended (7 USC §§ 2801 - 2814)	X		
Fish and Wildlife Conservation Act of 1980, PL 96-366 (16 USC §§ 2901 - 2912)		X	
Fish and Wildlife Coordination Act of 1934, PL 85-624, as amended (16 USC §§ 661 - 666c)		X	
Food, Agricultural, Conservation and Trade Act of 1990 (Pesticide Recordkeeping), PL 101-624, as amended (7 USC § 136i-1)			X
Forest Rangeland Renewable Resource Planning Act of 1974, PL 93-378 (16 USC §§ 1600 - 1614)		X	
Historic Preservation Certificates (36 CFR § 67)	X		
Historic Sites Act of 1935, as amended by PL 74-292, PL 100-17 (16 USC §§ 461 - 467)	X		
Hunting and Fishing Permits (32 CFR § 552.19)			X
Lacey Act of 1900, 31 Stat. 187, as amended (16 USC §§ 667e, 701)		X	X
Marine Mammal Protection Act of 1972, PL 92-522 (16 USC §§ 1361 - 1421h)			X
Migratory Bird Treaty Act of 1918, 40 Stat. 755, as amended (16 USC §§ 703 - 712)	X		
Memorandum of Understanding Among the DoD and the U.S. Fish and Wildlife Service and the International Association of Fish and Wildlife Agencies, Cooperative Integrated Natural Resources Management Program on Military Installations, January 31, 2006			
Multiple-Use Sustained Yield Act of 1960, PL 86-517 (16 USC §§ 528 - 531)		X	
National Environmental Policy Act of 1969, PL 91-190 (42 USC §§ 4321 - 4370d)	X		
National Historic Landmarks Program (36 CFR § 65)	X		
National Historic Preservation Act of 1966, PL 89-665, as amended (16 USC §§ 470 - 470x-6)	X		
National Register of Historic Places (36 CFR § 60)	X		
Native American Graves Protection and Repatriation Act of 1990, PL 101-601 (25 USC §§ 3001 - 3013)	X		
Native American Graves Protection and Repatriation Act Regulations (43 CFR § 10)	X		
Neotropical Migratory Bird Conservation Act of 2000, PL 106-247	X		
Noise Control Act of 1972, (42 USC §§ 4901 - 4918 [1999])	X		
North American Wetlands Conservation Act, PL 101-233 (16 USC §§ 4401 - 4414)	X		
Office of Management and Budget Guidance, Guidelines for Ensuring and Maximizing the Quality, Objectivity, Utility, and Integrity of Information Disseminated by Federal Agencies, October 10, 2001			
Outleasing for Grazing and Agriculture on Military Lands (10 USC § 2667)	X		
Pages 8931 through 8950 of Volume 72, Federal Register, Migratory Bird Rule			
Pages 62565 through 62572 of Volume 65, Federal Register			
Parts 13, 15, 21.15, and 22 of title 50, Code of Federal Regulations			
Part 230 of title 40, Code of Federal Regulations			
Preservation of American Antiquities (Antiquities Act Regulations) (43 CFR § 3)	X		
Protection of Archaeological Resources: Department of Defense Uniform Regulations (32 CFR § 229)	X		
Presidential Memorandum, Environmentally and Economically Beneficial Practices on Federal Landscaped Grounds, April 26, 1994			
Protection of Historic and Cultural Properties (36 CFR § 800)	X		
Rivers and Harbors Appropriations Act of 1899, 30 Stat. 1151, as amended (33 USC §§ 401 - 403)			X
Safe Drinking Water Act of 1974, PL 93-523, as amended (42 USC §§ 300f - 300j-26)	X		
Salmon and Steelhead Conservation and Enhancement Act of 1980, PL 96-561 (16 USC §§ 3301-3345)			X
Secretary of Interior's Standards for Historic Preservation Projects (36 CFR § 68)	X		

Law or Regulation	Influence		
	Direct	Indirect	Not Applicable
Sections 7701–7772 of Title 4, USC			
Sections 1588(a)(2), 2665, 2667(d) and (e), 2694b and c, and 2825 of Title 10, USC			
Section 21.210 of Title 32, CFR			
Sections 1341(a)(1)(B) and 1535-153613 of Title 31, USC			
Sikes Act Improvement Act of 1997 (Conservation Programs on Military Reservations), PL 86-797, as amended by PL 93-452 (16 USC §§ 670 - 670f)	X		
Soil and Water Resources Conservation Act of 1977, PL 95-192, as amended (16 USC §§ 2001 - 2009)		X	
Taylor Grazing Act of 1934, PL 73-482 (43 USC §§ 315 - 315o-2)		X	
Timber Sales on Military Lands (10 USC § 2665)			X
Title 42, USC 12			
Title 33, USC			
U.S. Fish and Wildlife Service and National Marine Fisheries Service, Endangered Species Consultation Handbook, March 1998			
Waiver of Federal Agency Responsibility under Section 110 of the National Historic Preservation Act (36 CFR § 78)			X
Water Resources Planning Act, PL 89-80, as amended (42 USC §§ 1962 - 1962d-20)		X	
Watershed Protection and Flood Prevention Act, PL 92-419 (16 USC §§1001 -1011, 33 USC 701)		X	
White House Office on Environmental Policy, Protecting America's Wetlands: A Fair, Flexible, and Effective Approach, August 24, 1993			
Wild and Scenic Rivers Act of 1968, PL 90-542, as amended (16 USC §§1271 -1287)			X

B.1.1 Sikes Act and Navy Instructions of INRMPs

This section provides an overview of the Sikes Act (as amended) and Navy instructions that require and guide the preparation of INRMPs. These laws and instructions identify the need for this document.

Sikes Act, PL 86-797 (16 USC §§ 670 - 670f)

Under the Natural Resources Management Act of 1960 (Sikes Act), PL 86-797, as amended by the 1997 Sikes Act Improvement Act, PL 105-85 (codified at 16 USC § 670 - 670f [1999]) (hereafter, Sikes Act [as amended]), the Secretary of Defense shall carry out a program for conserving and rehabilitating natural resources on military stations. To facilitate the program, the Secretary of each military department shall prepare and implement an INRMP for each military station in the United States under the jurisdiction of the Secretary. These plans must be consistent with the use of military stations to ensure the preparedness of the Armed Forces. The Secretaries of the military departments shall carry out the program to provide for the following:

- Conservation and rehabilitation of natural resources on military stations;
- Sustainable multipurpose use of the resources, which shall include hunting, fishing, trapping, and non-consumptive uses, subject to safety requirements and military security;
- Public access to military stations to use natural resources.

The Sikes Act (as amended) requires Navy facilities to manage their natural resources to provide multiple uses and public access to the extent that the military mission is not jeopardized. The Sikes Act (as amended) provides a mechanism whereby the DoD, the U.S. Department of the Interior, and the states cooperate to manage fish and wildlife on military stations.

Department of Defense Instruction 4715.03

DoDI 4715.03, Natural Resources Conservation Program, establishes policy and assigns responsibilities for compliance with applicable federal, state, and local statutory and regulatory requirements, EOs, Presidential memorandums, and DoD policies for the integrated management of natural resources, managed or controlled by DoD. The Instruction states that each DoD Component should ensure, to the extent practicable, that current and planned installation programs, plans, and projects that affect natural resources are integrated and compatible with INRMPs. It also states:

- All natural resources compliance requirements should be categorized based on the Programming and Budgeting Priorities for Natural Resources Programs (see Chapter 6).
- All DoD Components shall identify significant natural resources that are likely to remain on DoD lands and ensure the long-term sustainability of those resources.
- INRMPs shall integrate information relevant to natural resources with all other station and range planning documents.
- Each INRMP shall:
    1. Incorporate the principles of ecosystem-based management.
    2. Contain information needed to make appropriate decisions about natural resources management.
    3. Maintain a relevant and updated baseline list of plant and animal species located at each station for all pertinent taxonomic and regionally important groups.
    4. Ensure that sensitive natural resources, such as ecosystems or species, are monitored and managed for their protection and long-term sustainability.
    5. Ensure no net loss to the training and testing capability of the Station and enhance those capabilities to the maximum extent practicable.

OPNAVINST 5090.1C (30 October 2007)

The Navy's Environmental Protection and Natural Resources Manual, termed OPNAVINST 5090.1C (30 October 2007; Chapter 24 Natural Resources Management) establishes the Navy's program requirements for ensuring military readiness and sustainability, while complying with natural resources protection laws, and conserving and managing natural resources in the United States and its territories and possessions, for both appropriated and non-appropriated fund activities. OPNAVINST 5090.1C states: "This dual dynamic of Stewardship and Readiness is essential for the long-term maintenance of military and natural resources sustainability."

OPNAVINST 5090.1C describes the INRMP as "a long term planning document to guide the station Commander in the management of natural resources to support the Station mission, while protecting and enhancing natural resources for multiple uses, sustainable yield, and biological integrity. Each Station having custody of Class I property (land and water) suitable for the conservation and management of natural resources will prepare (or ensure preparation of) and implement a comprehensive INRMP that fulfills the requirements of the Sikes Act. The primary purpose of the INRMP is to ensure that natural resources conservation measures and military operations on the Station are integrated and consistent with stewardship and legal requirements. Professionally trained personnel will prepare INRMPs to support the Station's operational mission, meet stewardship and legal requirements, enhance the quality of life on the Station, and ensure station resources are managed through an ecosystem approach. Station commanders will continuously monitor INRMPs, review them annually, and revise them as necessary. They will renew INRMPs at least every five years. Natural resources managers are encouraged to use geographic information systems as the basis of their INRMP..."

NAVFAC P-73, Volume II

The Navy's Natural Resources Procedure Manual, referred to as NAVFAC P-73 Volume II, addresses all Chief of Navy Operations natural resources program requirements, guidelines, and standards. NAVFAC P-73 Volume II states that the principles of multiple-use, ecosystem, and adaptive management shall be implemented on Navy facilities that meet the natural resources stipulations outlined in OPNAVINST 5090.1C. NAVFAC P-73 Volume II requires that the following actions are undertaken to meet the natural resources program objectives:

- Each INRMP must adequately facilitate mission planning and decision-making to ensure compatibility of natural resources management with local, state, and federal objectives and policies.
- Implement land management practices that reduce grounds maintenance costs, use environmentally and economically beneficial landscaping practices, conserve soil and water, improve real estate values, protect wetlands and floodplains, abate nonpoint sources of water pollution, control noxious weeds, and prevent erosion.
- Inventory wetlands and manage Navy land to avoid the net loss of size, function, or value of wetlands.
- Identify and protect federally threatened and endangered species on Navy lands, emphasizing mission requirements and interagency cooperation during consultation, species recovery planning, and management activities.
- Outlease all lands that are suitable and available for agricultural uses, consistent with operational requirements and long-term ecosystem management goals.
- Reduce potential for bird and other animal collisions with aircraft in the airfield environment.
- Manage fish, wildlife, and plant resources within ecological limits, maintain appropriate wildlife population levels, and support optimum use of consumptive and non-consumptive fish and wildlife resources.

B.1.2 Relevant Federal Laws and Executive Orders

Endangered Species Act

Once a species is federally listed as endangered or threatened, regulations to protect the species from illegal take become applicable to any project that may affect an individual animal or its habitat. Take is defined as: "harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect" a listed species, or attempt to do so. The U.S. Fish and Wildlife Service (USFWS) was charged by Congress with overseeing ESA implementation for all species, except most marine species.

Section 7(a)(1) of the ESA states that all federal agencies shall use their authority by carrying out programs for the conservation of endangered species and threatened species listed pursuant to section 4 of the ESA. Conservation is defined in the ESA as "to use...all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this [ESA] are no longer necessary. Such methods and procedures include, but are not limited to, all activities associated with scientific resources management such as research, census, law enforcement, habitat acquisition and maintenance, propagation, live trapping, transplantation, and, in the extraordinary case where population pressures within a given ecosystem cannot be otherwise relieved, may include regular taking."

Under Section 7(a)(2) of the ESA, federal project proponents must consult with the USFWS if one or more listed species may be affected by a proposed action. Consultation with the USFWS may range from informal discussions to formal consultation requiring a Biological Assessment by the project proponent. For non-federal project applicants, the U.S. Army Corps of Engineers takes the lead in this consultation, if the issue is within their

jurisdiction. Other federal agencies may appropriately be named as the action agency that must conduct the consultation. With the issuance of a Biological Opinion "terms and conditions" are stated, which are measures to avoid or minimize the take of any listed species. When an "incidental take statement" is issued with the Biological Opinion, the federal project proponent may be excused from incidentally taking a listed species as part of the agency's otherwise lawful activity, as long as the specified taking conditions are met. Section 10 of the ESA also provides for a similar incidental take permit for private, state, and local government projects. To qualify, the project proponent must submit a habitat conservation plan and seek to minimize and mitigate the impacts of the taking to the "maximum extent practicable." The INRMP must undergo an internal Section 7 review by staff to determine if consultation is needed (USFWS and National Marine Fisheries Service 1998).

Critical habitat may be designated for a listed species, in which case such habitat may require special management consideration or protection. Section 318(a) of the National Defense Authorization Act for Fiscal Year 2004 (PL 108-136) made changes to the ESA regarding INRMPs, which were justified on the basis of the need to promote military readiness while protecting listed species. Under new Section 4(a)(3)(B)(i) of the ESA, the Secretary of the Interior or the Secretary of Commerce, as appropriate, is precluded from designating critical habitat on any areas owned, controlled, or designated for use by DoD where an INRMP has been developed that, as determined by the Interior or Commerce Secretary, provides a benefit to the species for which critical habitat designation is proposed. There is currently critical habitat designated at NAWS-CL for the Mohave Desert Tortoise in South Range, and the Inyo California towhee in riparian areas of North Range (See Chapter 3, Map 3-16 and Map 3-17).

Migratory Bird Treaty Act

The MBTA (16 USC §§ 703 et seq.) of 1918 is a federal statute that implements four treaties with the U.S. and Canada, Mexico, Japan, and Russia on the conservation and protection of migratory birds. It uses federal permits as a tool to assist in the conservation of migratory birds to authorize otherwise prohibited activities for scientific, educational, cultural, and other purposes.

The number of bird species covered by the MBTA is extensive and is listed at 50 Code of Federal Regulations (CFR) § 10.13. Further, the regulatory definition of migratory bird is broad and includes any variant or hybrid of an identified species and includes any part, egg, or nest of such bird (50 CFR §§10.12). A federal court in Washington, D.C. ruled in 2002 that the MBTA covers all migratory birds, even if they are invasive aliens. The Migratory Bird Treaty Reform Act of 2004 amended the MBTA to clarify that only species native to the U.S. are protected under that act. It clarified, in statute, that the protections and programs outlined in the MBTA of 1916 and the Congressionally approved regulations attached to the Act in 1918 apply only to native birds, not the increasing and increasingly problematic alien or exotic bird populations. As required by the Migratory Bird Treaty Reform Act, the USFWS has published a "List of Bird Species to Which the MBTA Does Not Apply", which includes "all non-native, human-introduced bird species..." It may be found in the Federal Register of 15 March 2005.

The MBTA, which is enforced by the USFWS, makes it unlawful "by any means or in any manner, to pursue, hunt, take, capture [or] kill" any migratory bird, or attempt such actions, except as permitted by regulation. The applicable regulations prohibit the take, possession, import, export, transport, sale, purchase, barter, or offering of these activities, except under a valid permit or as permitted by the implementing regulations (50 CFR § 21.11).

USFWS migratory bird depredation permits (50 CFR § 21.43) are required before any person may take, possess, or transport migratory birds, except for yellow-headed blackbirds (*Xanthocephalus xanthocephalus*), red-winged blackbirds (*Agelaius phoeniceus*), rusty blackbirds (*Euphagus carolinus*), Brewer's blackbirds (*Euphagus cyanocephalus*), cowbirds (*Molothrus ater*), all grackles, crows, and magpies found committing, or about to commit, depredations upon ornamental or shade trees, agricultural crops, livestock, or wildlife, or when

concentrated in such numbers and manner as to constitute a health hazard or other nuisance. When horned larks (*Eremophila alpestris*), golden-crowned (*Regulus satrapa*), white-crowned (*Zonotrichia leucophrys*) and other crowned sparrows, and house finches (*Carpodacus mexicanus*) are, under extraordinary conditions, seriously injurious to agriculture or other interests, the Commissioner of Agriculture may, without a permit, kill or cause to be killed, under his/her general supervision, such of the above migratory birds as may be necessary to safeguard any agricultural or horticultural crop. No permit is necessary merely to scare or herd depredating migratory birds, other than threatened or endangered species or bald or golden eagles.

The USFWS has sole authority for coordinating and supervising all federal migratory bird management activities, including enforcement of statutes regulating the taking of protected species (game and nongame) by individuals and federal agencies. The MBTA provides the USFWS the opportunity to comment on projects potentially affecting bird species, and their habitats, which are not protected under the ESA. Violations of the MBTA can result in criminal and civil penalty. Therefore, if a project has the potential to affect actively nesting birds or active nesting substrate (e.g. trimming nest trees) a qualified biologist from the Environmental Office must be contacted to determine if there will be any violations.

DoD Migratory Bird Rule and Guidance

On 31 July 2006, the DoD and the USFWS entered into a Memorandum of Understanding (MOU) to Promote the Conservation of Migratory Birds, in accordance with EO 13186, Responsibilities of Federal Agencies to Protect Migratory Birds. This MOU describes specific actions that should be taken by DoD to advance migratory bird conservation; avoid or minimize the take of migratory birds; and ensure DoD operations are consistent with the MBTA. The MOU also describes how the USFWS and DoD will work together cooperatively to achieve these ends. The MOU does not authorize the take of migratory birds; the USFWS, however, may develop incidental take authorization for federal agencies that complete an EO MOU.

In April 2007, further guidance was issued by the Office of the Under Secretary of Defense (Acquisition, Technology, and Logistics) on implementing the MOU to Promote the Conservation of Migratory Birds between the USFWS and DoD in accordance with EO 13186 (DoD 2007). This guidance covers all activities at NAWS-CL, including natural resources management, routine maintenance and construction, industrial activities, and hazardous waste cleanups. The guidance emphasizes interdisciplinary collaboration in the framework of North American Bird Conservation Initiative Bird Conservation Regions, collaborative inventory, and long-term monitoring.

The MOU places a priority on addressing the conservation of species of concern as resources are limited to effectively address all birds. Species of concern refers to those species listed in the periodic report USFWS Birds of Conservation Concern (USFWS 2008); priority migratory bird species documented in the comprehensive bird conservation plans (North American Waterbird Conservation Plan, U.S. Shorebird Conservation Plan, Partners in Flight Bird Conservation Plans); species or populations of waterfowl identified as high, or moderately high, continental priority in the North American Waterfowl Management Plan; listed threatened and endangered bird species in 50 CFR. 17.11; and MBTA listed game birds below desired population sizes.

The Migratory Bird Rule authorizes the military to "take" migratory birds during military readiness exercises under the MBTA, without a permit; however, if the military determines that the activity will significantly affect a population of migratory birds, they must work with the USFWS to implement conservation measures to minimize and/or mitigate the effects.

To sufficiently address effects on a population, the military must have a standard for a population. Population, as used in Section 21.15, is a group of distinct individuals of a single species, whose breeding site fidelity, migration

routes, and wintering areas are temporally and spatially stable sufficiently distinct geographically (at some time of the year). These parameters must have sufficient descriptions to allow for effective monitoring.

Significant adverse effect on a population, used in Section 21.15, means an effect that could, within a reasonable period of time, diminish the capacity of a population of migratory bird species to sustain itself at a biologically viable level. A population is "biologically viable" when its ability to maintain its genetic diversity, to reproduce, and to function effectively in its native ecosystem are not significantly harmed. This effect may be characterized by increased risk to the population from actions that cause direct mortality or a reduction in fecundity. Assessment of impacts should take into account yearly variations and migratory movements of the impacted species. Due to the significant variability in potential military readiness activities and the species that may be impacted, estimates of significant measurable decline will be determined on a case-by-case basis.

Conservation measures undertaken under the Migratory Bird Rule require monitoring and record keeping for five years from the date the Armed Forces commence their conservation action. During INRMP reviews, the Armed Forces must report the migratory bird conservation measures implemented and the effectiveness of the conservation measures in avoiding, minimizing, or mitigating take of migratory birds to the USFWS.

Many questions remain about how to implement the Migratory Bird Rule and the new guidance on the USFWS-DoD MOU. For example, how the evaluation of significance needs to be addressed in decision documents is still being worked out. Since the impact assessment must be conducted on populations of migratory birds, there may be a need to collect better population baseline data. Further developments in guidance for implementation of the Migratory Bird Rule should be followed closely.

Bald and Golden Eagle Protection Act

This law prohibits the "taking", through knowing action or wanton disregard, of bald (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*), including their parts, nests, or eggs. Take includes to "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb." Disturb means "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available 1) injury to an eagle, 2) a decrease in its productivity by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment by substantially interfering with normal breeding, feeding, or sheltering behavior."

National Environmental Policy Act of 1969, PL 91-190 (42 USC §§ 4321-4370D)

NEPA was signed on 01 January 1970, and became the basic national policy for protection of the environment. Its passage was driven by the broadly felt sentiment that federal agencies should lead the nation in environmental protection. Federal agencies must take into consideration the environmental consequences of proposed major actions. The spirit and intent of NEPA is to protect and enhance the environment through well-informed federal decisions, based on sound science. NEPA is premised on the assumption that providing timely information to the decision-maker and the public concerning the potential environmental consequences of proposed actions will improve the quality of federal decisions. Thus, the NEPA process includes the systematic, interdisciplinary evaluation of potential environmental consequences expected to result from the implementation of a proposed action. NEPA contains action-forcing procedures to ensure that environmental factors are taken into account on major decisions, and to document those decisions. Activities directly undertaken by, financed by, or requiring approval of federal agencies, respectively, are subject to NEPA environmental review processes, with only certain specified exceptions.

The NEPA is implemented by Council on Environmental Quality regulations (40 CFR 1500-1508). The most important function of agency compliance with NEPA procedure is to fully disclose and consider environmental information in decision-making and to inform the public of potential impacts and alternatives. However, if adverse environmental effects of a proposed action are identified and disclosed to the public, the agency may decide that other factors outweigh environmental impacts and continue with the action.

Three decisional mechanisms are implemented under NEPA. A proposed federal agency action is first reviewed to see if it can qualify for a categorical exclusion (usually small, routine projects with no potential significant environmental effect; categories are identified in agency NEPA policies). If not, then an environmental assessment (EA) or environmental impact statement (EIS) is prepared. If an EA is prepared and it concludes that adverse environmental impacts will be less than significant, then the agency can file a Finding of No Significant Impact (FONSI), followed by implementing its preferred alternative. If the proposed project has the potential to "significantly affect the quality of the human environment," then the EIS process must be followed. Briefly, these steps are: Notice of Intent, Scoping Process, Draft EIS, Agency/Public Review and Comment, Final EIS, Record of Decision, and Agency Action.

Project mitigation is usually used as a means to address adverse environmental impacts through the federal (NEPA) process. However, NEPA establishes no requirement to mitigate against adverse environmental impacts. “A complete or partial solution to an environmental problem" is a simple definition of a mitigation measure. To be adequate and effective, mitigation measures should fit under one of five categories, defined by the Council on Environmental Quality as:

1. Avoiding the impact by not taking certain action or parts of an action.
2. Minimizing the impact by limiting the degree or magnitude of the action and its implementation.
3. Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
4. Reducing or eliminating the impact over time by preservation and maintenance during the life of the action.
5. Compensating for the impact by replacing or providing substitute resources or environments.

An EIS must identify all relevant, reasonable mitigation measures that could lessen impacts to the human environment. However, a federal agency does not have to adopt mitigation measures included in an EIS unless agency-specific NEPA procedures require adoption of mitigation measures or the agency commits to implementing mitigation measures in the FONSI or Record of Decision.

NEPA compliance for INRMPs is specifically addressed by the Chief of Navy Operations guidance (Chief of Navy Operations Letter 5090 Ser N456F/8U589129 of 30 November 1998). The guidance is intended to be consistent with a Secretary of the Navy Memorandum (12 August 1998), which stated:

> All projects essential to fulfill the selected alternative (mix of management objectives) must be implemented within a time frame indicated in the INRMP. Any deviation or change from achieving the selected alternative may require supplementation to the EA or EIS and an opportunity for public comment. A station may add or modify projects for achieving the selected alternative without additional review under NEPA, if the projects are consistent with the existing NEPA analysis.

The memorandum also provided specific language for the Purpose and Need section of the NEPA document for the INRMP, for the Proposed Action and No Action alternatives, and for structuring each other alternative.

National Historic Preservation Act

The National Historic Preservation Act expanded the National Register of Historic Places and created an Advisory Council on Historic Preservation. Section 106 of the Act requires that federal agencies allow the Council an opportunity to comment whenever their undertakings may affect National Register of Historic Places resources or resources eligible for listing in the Register. Section 110 requires federal agencies to identify, evaluate, inventory, and protect National Register of Historic Places resources or resources eligible for the Register on property they control. The National Historic Preservation Act imposes no absolute preservation requirement, as long as the Navy follows and documents mandated data recovery procedures for any Navy decision not to preserve.

Archaeological Resources Protection Act of 1979

The Archaeological Resources Protection Act (16 USC §§ 470 et seq.1982) sets up penalties for destruction or removal of archaeological materials from federal land, without the proper permits. Requirements for obtaining permits are also established by this regulation.

California Desert Protection Act and Federal Land Policy and Management Act

The California Desert Protection Act (CDPA) of 1994 (PL lQ3-433) requires the Navy to develop a plan for management of withdrawn lands at NAWS-CL. The Comprehensive Land Use Management Plan meets this requirement. The CDPA also made NAWS-CL responsible for management of feral horses (*Equus caballus*) and burros (*Equus asinus*). The Federal Land Policy and Management Act of 1976 (PL 94-579) defines the planning approach and strategy for public lands, such as those withdrawn at China Lake. While the Comprehensive Land Use Management Plan is the overall land use plan for NAWS-CL, the INRMP also applies principles in Section 202(c) of Federal Land Policy and Management Act "Land Use Planning."

Executive Order 13112 (64 CFR 6183) Invasive Species

This EO seeks to "… prevent the introduction of invasive species and provide for their control and to minimize the economic, ecological, and human health impacts that invasive species cause." The EO seeks to improve coordination of federal agency efforts under a National Invasive Species Management Plan to be developed by the newly created interagency National Invasive Species Council. The Council has three co-chairs: the Secretaries of Agriculture, Commerce, and the Interior. Members also include the Secretaries of State, Defense, Homeland Security, Treasury, Transportation, and Health and Human Services, as well as the administrators of the U.S. Environmental Protection Agency, the U.S. Agency for International Development, the U.S. Trade Representative, and the National Aeronautics and Space Administration.

Federal activities are now coordinated through the National Invasive Species Council (established by the EO) and the Aquatic Nuisance Species Task Force (established by the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 and the National Invasive Species Act of 1996). This EO directs that federal agencies shall design, use, or promote construction practices that minimize adverse effects on the natural habitat where cost-effective and to the extent practicable. Federal agencies are restricted in the use of exotic (non-native) plant species in any landscape and erosion control plantings.

Other Relevant Executive Orders

Executive Order 11990-Protection of Wetlands. This EO directs federal agencies to "take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands." It states that federal agencies will avoid adverse impacts associated with the destruction or

modification of wetlands, wherever there is a practicable alternative. Under this EO, agencies are required to consider "factors relevant to a proposal's effect on the survival and quality of the wetlands." One such factor is the "...maintenance of natural systems, including conservation and long term productivity of existing flora and fauna, species and habitat diversity and stability, hydrologic utility, fish, wildlife, timber, and food and fiber resources."

Executive Order 11988-Floodplain Management. This EO states that executive agencies will preserve the natural and beneficial values served by floodplains, while managing federal lands. Activities in floodplains must be evaluated for their impacts during project planning, and alternative sites outside the floodplain must be considered.

Executive Order 11644-Use of Off-Road Vehicles on Public Lands. This EO requires federal agencies to establish policies and provide for procedures to ensure that the use of off-road vehicles on public lands will be controlled and directed so as to protect the resources of those lands, to promote the safety of all users of those lands, and to minimize conflicts among the various uses of those lands. The order clarifies agency authority to define zones of use by off-road vehicles on public lands by exempting fire, military, emergency, law enforcement, or combat/combat support vehicles.

Executive Order 13514-Federal Leadership in Environmental, Energy, and Economic Performance. This EO expands on the energy reduction and environmental performance requirements for federal agencies identified in EO 13423. The goal of EO 13514 is "to establish an integrated strategy towards sustainability in the Federal Government and to make reduction of greenhouse gas emissions a priority for federal agencies." EO 13423 (January 2007) established goals to guide energy and water conservation, building design and construction, waste and recycling, and procurement procedures were established.

B.1.3 Other Federal Acts

In addition to the laws discussed above, there are several other laws that must be considered in natural resources management. See Table B-1 for a list of major federal natural resources laws and regulations, along with a qualitative assessment on the likely influence on management activities at NAWS-CL. The Legal Information Institute, at http://www.law.cornell.edu/topics/environmental.html, provides the complete text of codified laws.

B.2 Laws, Regulations, Guidance, Joint Agreements, Biological Opinions, and Environmental Impact Statement Record of Decision

The following is a list of documents included in this Appendix:

- Cooperative Management Agreement between U.S. Fish and Wildlife Service, Bureau of Land Management, Naval Air Weapons Station China Lake, and California Department of Fish and Game for the Management of the Inyo California Towhee (Pipilo crissalis eremophilus). 11 June 2010.
- Biological Opinion for the Proposed Desert Tortoise Habitat Management Plan for the Naval Air Weapons Station, China Lake, California (5090 Ser PR241/397) (8-8-12-F-29). 19 February 2013.
- Biological Opinion on Maintenance Activities with Inyo California Towhee Habitat, Naval Weapons Air Station, China Lake, California (10570 Ser 0082/13102) (1-6-9-TA-25). 16 November 1990.
- Biological Opinion for the Removal of Aquatic Vegetation from Mohave Tui Chub Habitat (10570 Ser 2662/7546) (1-6-90-F-40). 24 July 1990.

- Biological Opinion for Enhancement of Mohave Tui Chub Habitat on the Naval Air Weapons Station, China Lake, Kern County, California (5090 Ser 83EOOOD/0567) (1-8-97-F-15). 02 May 1997.
- Biological Opinion on the Reinitiation of Formal Consultation on the Removal Aquatic Vegetation from Mohave Tui Chub Habitat on the Naval Air Weapons Station, China Lake, Kern County, California (5090 Ser 83EOOOD/1379) (1-8-97-F-39R). 07 August 1997.
  - Amendment to Biological Opinion 1-8-97-F-39R, Naval Air Weapons Station, China Lake, Kern County, California. 03 July 2002.
  - Amendment to Biological Opinion 1-8-97-F-39R, Naval Air Weapons Station, China Lake, Kern County, California. 08 August 2003.
- Record of Decision for Proposed Future Military Operational Increases and Implementation of Associated Comprehensive Land Use Management Plan and Integrated Natural Resources Management Plan, China Lake, CA. 26 May 2004.
- Interagency Agreement between Naval Air Weapons Station China Lake, Fire and Emergency Services and the U.S. Forest Service for Cooperation in the Prevention, Detection and Suppression of Wildland Fires, and Fuels Treatments and Prescribed Burning. 22 June 2011.
- Chief of Naval Operations Policy Letter Preventing Feral Cat and Dog Populations on Navy Property. 10 January 2002.
- Memorandum of Agreement between Commander, Navy Region Southwest and Bureau of Land Management, Ridgecrest Field Office on the Removal of Wild Horses and Burros. 06 May 2010.

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

IN REPLY REFER TO:
81440-2010-B-0173

JUN 17 2010

June 11, 2010

Environmental Management Division
Attn: John O'Gara
NAWS-CODE OPDK 39
429 E. Bowen Street, MS 4014
China Lake, California 93555-6108

Subject: Signed Cooperative Management Agreement for the Management of the Inyo California Towhee

Dear Mr. O'Gara:

I am pleased to forward to you the fully executed Cooperative Management Agreement for the Management of the Inyo California Towhee (*Pipilo crissalis eremophilus*) and appended Memorandum of Agreement developed by the office of the Commander, Navy Region Southwest. These documents have been signed by all participating agencies. I greatly appreciate your willingness to develop and enter into this agreement to promote the long-term conservation of the Inyo California towhee by continuing your on-going efforts which, to date, have proven to be effective in maintaining and enhancing its' habitat and populations.

If you have any questions, please contact me or Carl Benz, Assistant Field Supervisor, at telephone (805) 644-1766, extension 313 or extension 311, respectively. Thank you again for your support and interest in the recovery of the Inyo California towhee.

Sincerely,

Diane K. Noda
Field Supervisor

Attachments

List of Recipients:

Bureau of Land Management
Attn: Hector Villalobos
Bureau of Land Management
300 South Richmond Road
Ridgecrest, California 93555-4436

Environmental Management Division
Attn: John O'Gara
NAWS-CODE OPDK 39
429 East Bowen Street, MS 4014
China Lake, California 93555-6108

California Department of Fish and Game
Attn: Bruce Kinney
407 West Line Street
Bishop, California 93514

RDM W. D. French
Commander Navy Region South West
Flag Office, Mezzanine
937 North Harbor Drive
San Diego, California 92132

COOPERATIVE MANAGEMENT AGREEMENT

Between

U.S. DEPARTMENT OF THE INTERIOR

FISH AND WILDLIFE SERVICE

VENTURA FISH AND WILDLIFE OFFICE

VENTURA, CALIFORNIA

and

BUREAU OF LAND MANAGEMENT

NAVAL AIR WEAPONS STATION CHINA LAKE

CALIFORNIA DEPARTMENT OF FISH AND GAME

for the

MANAGEMENT OF THE INYO CALIFORNIA TOWHEE

(*Pipilo crissalis eremophilus*)

I. PURPOSE

This Cooperative Management Agreement (Agreement) is entered into between the U.S. Department of Interior, Fish and Wildlife Service (Service); the Bureau of Land Management (BLM); the Naval Air Weapons Station (NAWS) China Lake; and the California Department of Fish and Game (CDFG) (hereinafter collectively referred to as "Parties"). The purpose of this Agreement is to provide an administrative framework for the Parties to continue their respective on-going, long-term conservation efforts for the benefit of the federally listed (threatened) Inyo California towhee (towhee) (*Pipilo crissalis eremophilus*).

The BLM, the NAWS China Lake, and the CDFG have achieved substantial improvements in the status of the towhee through focused resource planning and conservation measures to protect, restore, and conserve Inyo California towhee habitat. By signing this Agreement, the Parties commit to the long-term conservation of the towhee and its habitat and commit to continuing those conservation measures currently being conducted that have proven to be effective in enhancing and maintaining the towhee's habitat. The Parties agree that implementation of the measures described in this Agreement (subject to funding availability) would contribute to the long-term conservation of the towhee.

The towhee was listed as threatened by the U.S. Department of Interior, Fish and Wildlife Service on August 3, 1987 (52 FR 28780). The California Fish and Game Commission had previously listed the towhee as "endangered" on October 2, 1980. The biology, distribution, population trends, and habitat of the Inyo California towhee are described in detail in the *Recovery Plan for Inyo California Towhee* (Service 1998) and the 5-year review of the towhee (Service 2008). Approximately 26 percent of the known range of the towhee is managed by the BLM, 68 percent by the NAWS China Lake, 5 percent by the CDFG, and 1 percent private (see map).

On April 10, 1998, the Service approved the *Recovery Plan for Inyo California Towhee* (Service 1998). The strategy for the recovery of the towhee in the plan was to monitor towhee populations and habitat, eliminate habitat threats, and rehabilitate those habitats that have been degraded or destroyed, with the ultimate goal of delisting the towhee. Recovery actions identified in the plan included: management of burros and horses; protection of springs; elimination or control of exotic and invasive vegetation; restriction of incompatible development, mining operations, and military activities; and management of off-highway vehicle (OHV) and other recreational activities.

II. AUTHORITIES

This Agreement is entered into under the following authorities:

U.S. Fish and Wildlife Service

The Service is authorized under the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1548) (1988)); Fish and Wildlife Conservation Act of 1980 (16 U.S.C. 2912 (1988)); Fish

and Wildlife Act of 1956 (16 U.S.C. 742f (1988)); and the Fish and Wildlife Coordination Act (16 U.S.C. 661 (1988)).

Bureau of Land Management

The BLM is authorized under section 307(b) of the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1737), the Migratory Bird Treaty Act of 1918 (MBTA; 16 U.S.C. 703–711; 40 Stat. 755), and the Sikes Act (16 U.S.C. 670).

Naval Air Weapons Station China Lake

The NAWS China Lake is authorized under the Conservation Programs on Military Installations (Sikes Act), as amended (16 U.S.C. 670 (a) et seq.); Endangered Species Act of 1973 (ESA), as amended ("Interagency Cooperation" 16 U.S.C. Section 1531 et seq.,); Migratory Bird Treaty Act (MBTA), as amended (16 U.S.C. 703 et seq.); Executive Order 13186 - Responsibilities of Federal Agencies to Protect Migratory Birds; California Desert Protection Act, Public Law 103-433; and the Navy Environmental and Natural Resources Program Manual (Office of the Chief of Naval Operations (OPNA) 5090.1B).

California Department of Fish and Game

The CDFG is authorized as the trustee agency for fish and wildlife in California under Fish and Game Code Section 1801 et seq., the California Endangered Species Act (Fish and Game Code Section 2050 et seq.), and California Code of Regulations Title 14, Sections 750-753. In addition, CDFG and the Service are currently parties to a more wide-ranging cooperative agreement entitled Cooperative Agreement Between the California Department of Fish and Game and the U.S. Fish and Wildlife Service, Endangered and Threatened Fish, Wildlife and Plants, last updated in 1991.

III. BACKGROUND

The Inyo California towhee occurs on the west and east slopes of the southern Argus Mountains in Inyo County, California (see map). The Argus range is a north-south oriented range located between the Sierra Nevada to the west and the Panamint and Slate ranges to the east. Elevations range from approximately 2,680 to 6,200 feet above sea level; summer and winter weather conditions can be extreme. Surface water is limited to seeps, springs, and ephemeral creek flow (Wilbur 1981, Service 1998). The towhee occurs in areas of dense riparian vegetation and adjacent upland habitats.

The Inyo California towhee was state listed as endangered and federally listed as threatened because of habitat loss and alteration as a result of grazing, browsing, and trampling by feral burros, horses, and cattle. At that time it was believed that there were no more than 200 individuals remaining range wide. Other threats to the towhee and its habitat when it was listed included recreational activities, water diversion, fire, mining, and invasive plants (52 FR 28780).

As a result of the ongoing conservation measures by the Parties such as the removal of cattle, feral burros and horses, fencing of towhee habitat, increasing habitat protection (e.g., creating the Great Falls Basin Area of Critical Environmental Concern (ACEC)), restricting recreational activities, and fire management, significant progress has been made toward improving and protecting Inyo California towhee habitat and increasing towhee abundance. The recovery plan recommended that the Inyo California towhee could be delisted when the population had been sustained at 400 individuals for a 5-year period. From 1998 to the present, the population is estimated to have ranged from 640 to 741 individuals (LaBerteaux and Garlinger 1998, LeBerteaux 2004, LeBerteaux 2008).

IV. CONSERVATION MEASURES FOR THE INYO CALIFORNIA TOWHEE

By way of this Agreement, each Party intends to continue to implement the following measures subject to funding availability:

A. Bureau of Land Management (BLM)

The BLM is committed to the recovery and long-term conservation of the Inyo California towhee on its lands. The BLM will continue to conduct a variety of conservation measures including: maintaining protections for towhee habitat; removing feral burros and horses from the towhee's range; fencing of towhee habitat; eliminating, reducing, or restricting recreational activities in towhee habitat; removing invasive plants; fire management; conducting outreach to educate the public and promote conservation; and monitoring.

1. The BLM will continue towhee habitat protection and thereby reduce, control, or in some cases, eliminate human-related impacts within towhee habitat under their jurisdiction. The BLM will continue to protect all identified towhee habitat on BLM land. The Great Falls Basin ACEC, which includes a large portion of the towhee's habitat, will continue to be managed according to the *Great Falls Basin Area of Critical Concern Management Plan* (1987), under the provision of the Sikes Act, for the specific goal to "manage habitat for the Inyo California towhee so that the population will be at a maximum sustained level."

2. The BLM considers potential impacts to biological resources, including the towhee and its habitat, during project review and its National Environmental Policy Act (NEPA) planning process and is committed to continuing this policy regardless of whether or not the species is federally or state listed.

3. The BLM will continue long-term protection and preservation of wilderness, scenic, cultural, and natural characteristics for recreation, scientific, and educational purposes within the Argus Range Wilderness. The BLM will continue to enforce prohibited activities pursuant to the Wilderness Act within designated wilderness areas. Among these prohibitions are the following: no roads, no structures, no commercial activities, no use of motorized vehicles or equipment, and no landing of aircraft.

4. The BLM will continue conservation measures for the ongoing protection of the Inyo California towhee identified in the West Mojave Management Plan amendment to the California Desert Conservation Area Plan, which was approved by the BLM in 2006. Specifically, the plan amendment established critical standards for rangeland health. These standards were developed to meet or exceed the national policy for the protection of watersheds, ecological processes, water quality, and native wildlife habitats. These critical standards also address riparian/wetland and stream habitats to ensure hydrologic conditions are maintained.

5. The BLM is committed to the long-term management of burros and horses within the range of the towhee, and will continue to limit the number of burros and horses at a level where they are not having an impact on the towhee and its habitat. Burro and horse management is included in the West Mojave Plan, which states: "Continue removal of feral burros from the Argus Mountains with a goal of zero." The BLM will continue to manage for zero burros as a means to maintain the towhee's habitat in proper functioning condition.

6. The BLM inspects fencing and barriers on an ongoing basis and makes necessary repairs, and the BLM is committed to continuing this process. The BLM will maintain fences around 9 of the 27 towhee nesting areas on their land to eliminate grazing by burros and horses, eliminate OHV activity, and reduce other types of recreational use (e.g., camping). Fencing of additional nesting areas will be implemented if habitat becomes impacted by grazing or recreational use. Other barriers, including boulders, constructed around four towhee nesting areas along with signage to manage OHV activity will be maintained. The BLM will continue to monitor restoration efforts (e.g., willow planting) in two areas, and will restore other habitats as needed. New hiking trails, which have further reduced impacts in some areas by encouraging hiking outside riparian habitat, will be maintained to limit damage to riparian areas.

7. The BLM will continue to monitor towhee habitat for signs that invasive plants are having an effect on territory occupancy, reproduction, abundance, or some other aspect of towhee biology. The BLM considers tamarisk control to be a high priority for maintaining functioning habitats. Working with volunteers, the BLM has removed tamarisk from one towhee nesting area and will continue to do so in those areas where it is having a noticeable impact, such as Water Canyon and Shepherd Canyon, which the BLM is addressing.

8. The West Mojave Plan provides guidance on fire management activities, especially in Desert Wildlife Management Areas (DWMA), Habitat Conservation Areas, and other special areas. The general recommendations are for more hand crew work and less use of heavy equipment. BLM will continue to implement the *Bureau of Land Management California Desert District Field Office, Fire Management Plan* (2004), which outlines responsibilities between the BLM and the NAWS China Lake.

9. The BLM, with the help of volunteers, is committed to continuing an outreach program to reduce vehicle threats to towhees and towhee habitat. The BLM will coordinate with

groups like the Audubon Society to develop, as funds are available, a pamphlet describing the towhee and its habitat, biology, and threats to the species. The BLM, with help from volunteers, will maintain educational kiosks in the town of Trona and at the Great Falls Basin ACEC. The kiosks provide information on the life history and status of the towhee as well as a short history of Great Falls Basin itself. The kiosks also provide information on what activities are restricted and where they are permitted emphasizing the need for cooperation with the local community.

10. The BLM will continue monitoring, which has been ongoing for more than 20 years, of 27 key towhee habitat areas for potential threats, and will continue to support scientifically-conducted surveys of towhee abundance and distribution. The BLM is committed to continue to monitor these key areas and to take any necessary action to prevent any measured impacts from potential threats from affecting towhee populations. The BLM is committed to working with the NAWS China Lake and the CDFG to monitor towhee populations, subject to funding availability, as described later in this Agreement.

11. The BLM will verify the existence of other populations of towhee, including the recently reported population in the Panamint Range.

B. Naval Air Weapons Station China Lake (NAWS China Lake)

The NAWS China Lake recognizes that compliance with environmental regulations and conservation of natural resource is integral to successful implementation of the Station's primary mission: the research, development, test and evaluation of air weapons systems. The NAWS China Lake is committed to the long-term conservation of the Inyo California towhee on its lands. The NAWS China Lake will continue a variety of conservation measures including: considering and avoiding (to the maximum extent possible) potential impacts during planning efforts, removing feral burros and horses from the towhee's range, fencing of towhee habitat, removing invasive plants, and monitoring.

1. Operations and training activities on the NAWS China Lake are mainly limited to designated areas, none of which occur within or adjacent to any towhee nesting area or riparian habitat. If construction and training operations are planned outside currently designated areas, the NAWS China Lake avoids known towhee-occupied riparian habitat as part of its ongoing conservation for the towhee and is committed to continuing this policy.

2. The NAWS China Lake considers potential impacts to biological resources, including the towhee and its habitat, during project review and its National Environmental Policy Act (NEPA) planning process and is committed to continuing this policy regardless of whether or not the species is federally or state listed.

3. Additional towhee conservation is afforded through implementation of the installation's Integrated Natural Resources Management Plan (INRMP). Ongoing towhee management programs are reviewed annually and will, if necessary, be further refined in the five-year

INRMP update which is currently in progress. The revised INRMP will incorporate all Navy protection requirements as stipulated in this Cooperative Management Agreement.

4. The NAWS China Lake will continue to monitor and coordinate projects to ensure impacts to nesting towhees or critical habitat will be avoided to the maximum extent possible. The NAWS China Lake does not conduct road maintenance activities, such as patching and sealing, near occupied towhee habitat during the nesting season and will continue that policy.

5. The NAWS China Lake is committed to the long-term management of burros and horses on its lands. Burro and horse management is included in the NAWS China Lake's INRMP. Burro and horse population management will continue at a level where impacts on the towhee and its habitat are minimized to the maximum extent possible.

6. The NAWS China Lake will continue to maintain fences around towhee habitat (e.g., Birchum Springs) to eliminate grazing by burros and horses on an as needed and funding availability bases. The NAWS China Lake is closed to the public, and therefore is not subject to impacts from recreational activities.

7. The NAWS China Lake is committed to removing tamarisk on a funding availability basis from various locations and will continue to target tamarisk when found in known towhee habitat and riparian locations throughout the North Ranges. Tamarisk removal is a management priority. Tamarisks have so far been removed from three different locations in Wilson Canyon. Additionally, less intensive tamarisk removal in Mountain Springs Canyon has been conducted for many years and will continue as necessary.

8. The NAWS China Lake will continue to implement fire suppression in accordance with installation policies and procedures. The NAWS China Lake will continue to monitor wildland fires in relation to sensitive resources, including important towhee nesting habitat, and will use available measures (e.g., aerial drops) to protect towhees when they are threatened.

9. The NAWS China Lake has funded surveys of towhees and their habitat on its land since the species was listed (LaBerteaux and Garlinger 1998, LeBerteaux 2008). The NAWS China Lake is committed to continuing monitoring of towhee populations, subject to funding availability, as outlined later in this Agreement. The NAWS China Lake may also include in their monitoring efforts upland and riparian areas not currently known to be occupied by towhees.

C. California Department of Fish and Game (CDFG)

The CDFG is committed to the recovery and long-term conservation of the Inyo California towhee. The 520-acre Indian Joe Spring Ecological Reserve (Reserve), located approximately 5 miles north of the town of Trona in the Argus Range of the Mojave Desert, is part of designated critical habitat for the towhee. CDFG will continue to protect riparian habitat and springs and

control deleterious native and non-native species (brown-headed cowbirds, feral burros and horses, and tamarisk) within the Reserve when necessary.

1. An administrative draft Land Management Plan for the Reserve has been completed and a final plan will be prepared. The final plan will include long-term management measures specific to the towhee. CDFG will continue to maintain a pipe corral exclosure around the main spring as necessary to protect it from grazing damage by feral burros. Management activities on the Reserve will continue to optimize towhee habitat and populations, as well as to benefit other native species found within the area.

2. Seven bird surveys (five general and two specific for Inyo California towhee) were conducted at the Reserve from 1995-2004. CDFG is committed to working with the BLM and the NAWS China Lake to monitor towhee populations, subject to funding availability, as described in this Agreement.

V. MONITORING PLAN

The Parties recognize that a monitoring program is needed to ensure that ongoing management actions continue to benefit the towhee and that the population remains stable (i.e., the overall population trend remains within the bounds of natural fluctuations). By way of this Agreement, the Parties intend to implement the following monitoring plan subject to funding availability:

1. Survey protocol for assessing towhee abundance, habitat quality, water flow, and land usage will be the same as that developed by LaBerteaux and Garlinger (1998). This protocol has been used in all range-wide towhee surveys since 1998 (LaBerteaux and Garlinger 1998; LaBerteaux 2004, 2008). To account for environmental variability and to provide for a sufficient number of surveys to observe population trends, surveys will be conducted over a period of at least 12 years beginning with the most recent survey in spring 2007 (LaBerteaux 2008); therefore, monitoring should be completed by 2019.

2. Based on the frequency of past surveys, complete surveys of known and potential towhee habitat will be conducted every 4 years depending on funding and staff availability, with at least three complete surveys being conducted during the 12-year period. Each Party will ensure that surveys on their property are completed within each 4-year period. The range in the number of years between surveys will provide the Parties some flexibility in obtaining funding and allow for year-to-year environmental changes characteristic of the towhee's desert habitat.

3. A report will be prepared on the results of each survey and will be provided to all Parties and made available to the interested public. Survey reports will specifically address towhee population trends. All Parties will meet annually to discuss towhee related issues, such as the timing of future surveys, funding for surveys, tamarisk removal, any new threats, and potential new conservation measures. After each complete survey of known and potential towhee habitat (i.e., about every 4 years) the Parties will meet to review the results and the status of the towhee and to plan future conservation measures.

VI. GENERAL PROVISIONS

The BLM, the NAWS China Lake, and the CDFG agree to continue these conservation measures, with the assistance of the Service, both through the recovery period for the Inyo California towhee, and subsequent to its state or federal delisting, if applicable.

1. A change in the species' legal status will not affect the commitment of the Parties to continue ongoing conservation measures for the long-term conservation of this sensitive species irrespective of its standing under the Federal or California Endangered Species Acts. This Agreement, and any modification to this agreement, will be reviewed and modified no less than every five years to ensure that the continued conservation of the Inyo California towhee is based on the best possible scientific knowledge and understanding of its role in the ecosystem. At any time, the Parties may modify existing conservation measures or recommend new ones in response to any new threats to the towhee that may occur consistent with the amendment process described below. This Agreement constitutes a long-term commitment to the conservation of this important species.

2. This Agreement and the above-referenced management strategies will be re-evaluated as needed and may be amended or renewed by mutual consent of the Parties based on the status of the towhee and its habitat. If amended, any additional management strategies will either be attached as an appendix or formal amendment to this Agreement or incorporated through the revision of this Agreement.

3. The Parties will ensure that the Agreement and the actions covered in the Agreement are consistent with applicable Federal, State, and Tribal laws and regulations. The Parties will ensure that the terms of this Agreement will not be in conflict with any ongoing conservation or recovery programs for the towhee.

4. Nothing in this Agreement will be construed to limit or constrain any Party or any other entity from taking additional actions at its own expense to protect and conserve the towhee.

5. Nothing in this Agreement shall limit the responsibility of Federal and State conservation authorities to perform their lawful duties (e.g., pursuant to any provision of the Endangered Species Act, Migratory Bird Treaty Act, or Clean Water Act), and conduct investigations as authorized by statute and by court guidance and direction.

6. Each Party shall have all remedies otherwise available to enforce the terms of the Agreement, except that no Party shall be liable in damages for any breach of this Agreement, any performance or failure to perform an obligation under this Agreement, or any other cause of action arising from this Agreement.

7. Nothing in this Agreement shall be construed as obligating the Parties to provide resources to the other or expend any funds in excess of appropriations authorized by law. This Agreement shall become effective beginning on the date of the last signature below.

VII. ANTI-DEFICIENCY ACT

While the parties agree that their annual budget submissions will be sufficient to cover the tasks and goals described herein, pursuant to the Anti-Deficiency Act, 31 U.S.C. §1341, et seq., any requirement for the payment or obligation of funds, including funding for staffing resources, pursuant to this Agreement, shall be subject to the availability of funds appropriated by Congress, and no provision herein shall be interpreted to require obligation or payment of funds in advance of an appropriation. Nor shall this Agreement be construed to require the violation of any other applicable federal law.

VIII. TERMINATION

Any Party may terminate participation in this Agreement by a procedure that begins with written notification to the other Parties that such measure is being considered. Within 30 days of such notification, the Parties will meet to informally address all concerns raised. If resolution of the concerns cannot be negotiated, participation in the Agreement may be dissolved upon written notice by the Party wanting to terminate.

IX. SIGNATURES

IN WITNESS WHEREOF, the Parties hereto executed this Agreement on the date(s) set forth below.

Field Supervisor
Ventura Fish and Wildlife Office
U.S. Fish and Wildlife Service

6/15/10
Date

Field Manager
Ridgecrest Field Office
Bureau of Land Management

July 23, 2009
Date

Commander
Navy Region South West

3 March 2010
Date

Deputy Regional Manager
Bishop Field Office
California Department of Fish and Game

04/23/2010
Date

APPENDIX A

Literature Cited

LaBerteaux, D.L. 2004. Inyo California Towhee (*Pipilo crissalis eremophilus*) Survey in the Argus Range, Inyo County, California. Unpublished report prepared for the Bureau of Land Management, Ridgecrest, California. November 2004. 62 pp.

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LaBerteaux, D.L., and B.H. Garlinger. 1998. Inyo California Towhee (*Pipilo crissalis eremophilus*) census in the Argus and Coso Mountain Ranges, Inyo County, California.

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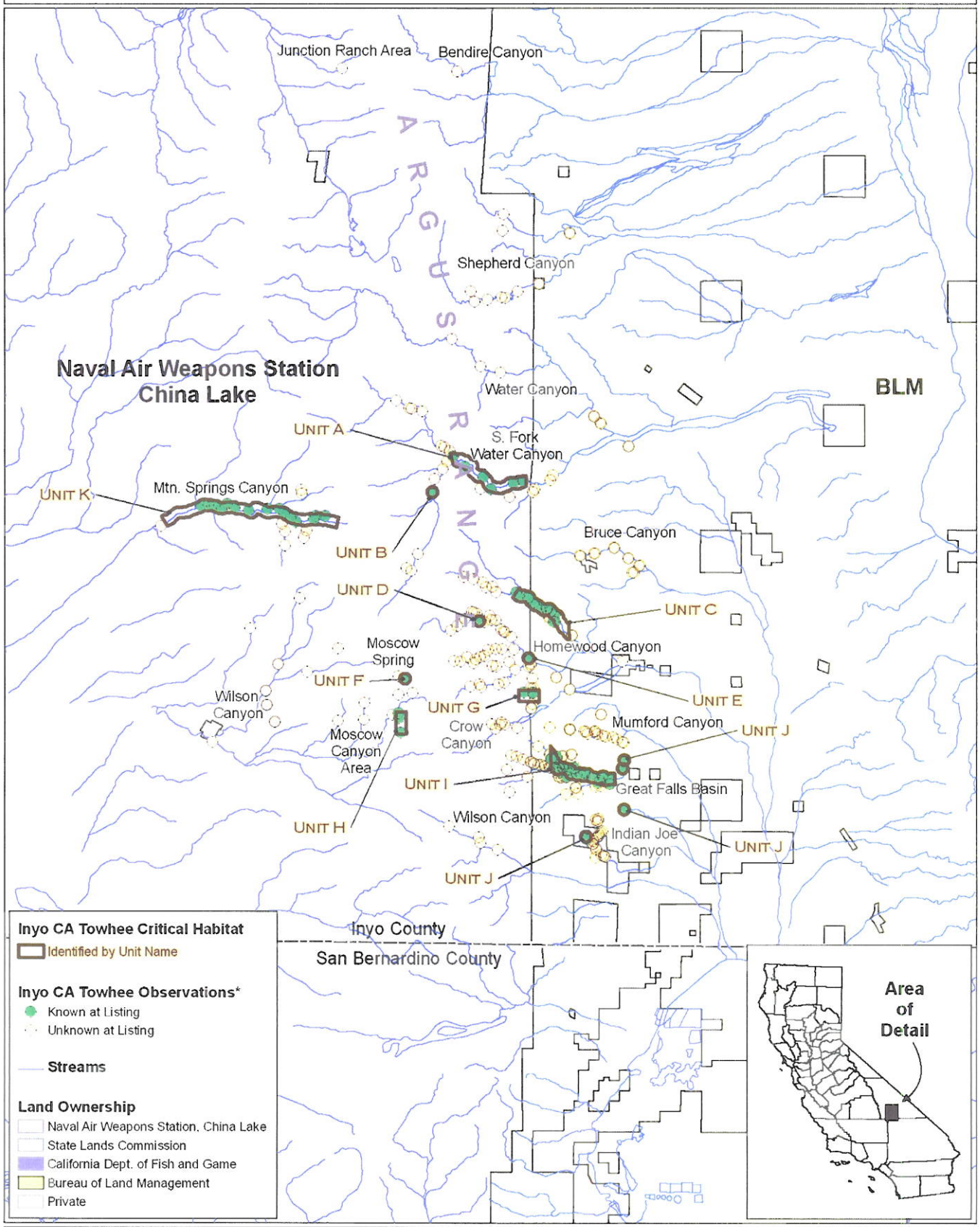
Inyo California Towhee Observation Records



U.S. Fish & Wildlife Service
Ventura Fish & Wildlife Office GIS
April, 2009

0 2.5 5 Miles

*Inyo California towhee observations:
D. LaBerteaux (1998 and 2004);

COMMANDER, NAVY REGION SOUTHWEST
937 N. HARBOR DRIVE
SAN DIEGO, CALIFORNIA 91932

U.S. DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
VENTURA FISH AND WILDLIFE OFFICE
VENTURA, CALIFORNIA
2493 PORTOLA ROAD, SUITE B
VENTURA, CALIFORNIA 93003

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300 SOUTH RICHMOND ROAD
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CALIFORNIA DEPARTMENT OF FISH AND GAME
407 WEST LINE STREET
BISHOP, CALIFORNIA 93514

CNRSW
N00242-20100113-CL18-MOA

MEMORANDUM OF AGREEMENT
BETWEEN
COMMANDER, NAVY REGION SOUTHWEST
U.S. FISH AND WILDLIFE SERVICE
BUREAU OF LAND MANAGEMENT
AND
CALIFORNIA DEPARTMENT OF FISH AND GAME

Subj: COOPERATIVE MANAGEMENT AGREEMENT FOR THE MANAGEMENT OF THE INYO CALIFORNIA TOWHEE, ADDENDUM ONE (1) TO ORIGINAL AGREEMENT

Encl: (1) Cooperative Management Agreement, July 2009

1. Purpose. The purpose of this Addendum to the original agreement is to correct Department of the Navy (DoN) administrative discrepancies regarding the signature authority for the DoN and also adding required terms for DoN inter-governmental agreements.

Subj: COOPERATIVE MANAGEMENT AGREEMENT FOR THE MANAGEMENT OF THE INYO CALIFORNIA TOWHEE, ADDENDUM ONE (1) TO ORIGINAL AGREEMENT

2. Background. The original agreement was developed between Naval Air Weapons Station (NAWS) China Lake and the 3 additional governmental parties. Within the area of authority assigned to the Commander, Navy Region Southwest (CNRSW), only the Commander may sign and commit the United States government to this particular type of inter-governmental agreement. For this reason, an addendum to the original agreement has been prepared.

3. Scope. This agreement is an administrative exercise that seeks to correct administrative steps and required clauses for CNRSW inter-governmental agreements. It will incorporate the entire original agreement. This addendum in no way changes substantive elements in the original agreement.

4. Agreement/Understanding. CNRSW will affirm and commit to all terms and conditions assigned to the DoN in the original agreement, enclosure (1).

5. Changes. Changes may be made to the original agreement by mutual written consent of both parties, and will be recorded and published as addenda to this agreement.

6. Expiration. This agreement, both the addendum and the original agreement will remain in effect until July 30, 2015. At that time, all parties may mutually agree to continue; however, a new set of dated signatures and a MOA addendum must be developed that evidences continuation.

7. Effective Date. This MOA Addendum will become effective on the date of the last signature.

3/4/10

W. D. FRENCH (date)
Rear Admiral, U.S. Navy
Commander, Navy Region Southwest

6/15/10

(name) (date)
Field Supervisor
Ventura Fish and Wildlife Office
U.S. Fish and Wildlife Service

Subj: COOPERATIVE MANAGEMENT AGREEMENT FOR THE MANAGEMENT OF THE INYO CALIFORNIA TOWHEE, ADDENDUM ONE (1) TO ORIGINAL AGREEMENT

Feb. 3, 2010

(name) (date)
Field Manager
Ridgecrest Field Office
Bureau of Land Management

04/23/2010

(name) (date)
Deputy Regional Manager
Bishop Field Office
California Department of Fish and Game

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

IN REPLY REFER TO:
08EVEN00-2012-F-0364

February 19, 2013

John O'Gara
Head, Environmental Management Division
Naval Air Weapons Station
1 Administration Circle
China Lake, California 93555-6100

Subject: Biological Opinion for the Renewal of the Naval Air Weapons Station, China Lake Public lands Withdrawal, California (5090 Ser PR241/397) (8-8-12-F-29)

Dear Mr. O'Gara:

This document transmits the U.S. Fish and Wildlife Service's (Service) biological opinion based on our review of the proposed land withdrawal renewal and its effects on the federally threatened desert tortoise (*Gopherus agassizii*) and its critical habitat, in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). We received your May 24, 2012 request for formal consultation on May 30, 2012.

This biological opinion is based on information which accompanied your request for consultation, including the biological assessment (Navy 2012), annual reports from the Navy on previous biological opinions (Navy 1996-2011), and conversations and correspondence with Navy staff. A complete record of this consultation can be made available at the Ventura Fish and Wildlife Office.

Consultation History

On June 25 and 26, 2012, we met with the Navy to discuss details addressed in its biological assessment. Subsequent communication between the Service and the Navy via electronic mail and phone conversations further refined the Navy's project description and analyses. Our analysis in this biological opinion reflects changes made to the Navy's biological assessment after consultation was initiated.

Three federally listed species occur within the action area: the endangered Mohave tui chub (*Siphateles bicolor mohavensis*), the threatened Inyo California towhee (*Pipilo crissalis eremophilus*), and the desert tortoise. Critical habitats for the desert tortoise and Inyo California towhee occur within the action area of this biological opinion. The Navy determined that the proposed action is not likely to adversely affect the Mohave tui chub or the Inyo California towhee and its critical habitat. These species and critical habitat of the Inyo California towhee

occur in small areas of the installation that the Navy generally does not use for ground-disturbing activities. The Navy may infrequently conduct specific activities in these areas; on such occasions, it will consult with the Service on these proposed actions. We acknowledge that wildfire caused by the Navy's activities is a potential threat although test and target sites are located far from their habitats. Because such wildfires are not planned or legal activities, we will not consider them in this biological opinion. (By wildfire in this context, we are referring to fires that are not predictable (e.g., a large fire caused by the crash of aircraft during a wind storm. We will consider the effects of the more routine and smaller fires that may occur during the use of target and test sites.) In the event that the Navy needs to respond to a wildfire that may affect these species, it would request emergency consultation, pursuant to the implementing regulations for section 7(a)(2) of the Act 9 (50 Code of Federal Regulations 402.05). Therefore, we concur with the Navy's determination that the proposed action is not likely to adversely affect the Mohave tui chub, Inyo California towhee, or critical habitat of the Inyo California towhee.

In the Navy's initial May 24, 2012, request for consultation, it requested our concurrence on its determination that the proposed action would have no effect on the endangered southwestern willow flycatcher (*Empidonax traillii extimus*) and least Bell's vireo (*Vireo bellii pusillus*). In subsequent correspondence, the Navy altered this determination, concluding that its proposed action is not likely to adversely affect either species. Although willow flycatchers and Bell's vireos are common migrants in riparian habitat in the northern portion of the installation, sufficient information is not available to determine whether these migrants are the endangered subspecies. Regardless of the taxonomic status of these migrants, the Navy does not conduct activities in these riparian areas. Wildfire caused by the Navy's activities may affect these riparian areas; if a fire did occur, the same factors would apply that we described in the previous paragraph. For these reasons, we concur with the Navy's determination that the proposed action is not likely to adversely affect either southwestern willow flycatcher or least Bell's vireo.

We provided a draft biological opinion to the Navy on December 10, 2012 (Service 2012b). The Navy provided comments on the draft biological opinion via electronic mail (Campbell 2013); we have incorporated the comments, as appropriate.

BIOLOGICAL OPINION

DESCRIPTION OF THE PROPOSED ACTION

The proposed action includes: 1) Congressional renewal of the land withdrawal (25-year renewal), 2) an increase of up to 25 percent in operational tempo within current land use areas approved for designated uses, 3) an expansion of unmanned aerial and surface systems, and 4) an expansion of existing and an introduction of evolving directed energy weapons development. Land use and nonmilitary activities on the Naval Air Weapons Station would continue according to current patterns of use; that is, the proposed increases in operational tempo would be accommodated in existing, approved use areas. Natural and cultural resources would continue to

be conserved with the implementation of the management process defined in the installation's Comprehensive Land Use Management Plan. Numerous customers use the Naval Air Weapons Station to conduct a wide range of activities; Navy environmental staff at the Naval Air Weapons Station work with these customers to ensure they are aware of the natural resources that are present on the installation.

The Navy's biological assessment described its proposed activities in technical terms. For this biological opinion, we worked with the Navy to assess the threats to desert tortoises and their critical habitat associated with each proposed activity. The following table lists the Navy's activities and notes the general manner by which the activity would affect the desert tortoise and its critical habitat (e.g., ground disturbance, use of roads, etc.). We will then consider more specifically the nature of these effects on the desert tortoise and its critical habitat and the measures that the Navy has proposed to avoid, reduce, or minimize these effects. The Navy's biological assessment contains a more detailed description of its activities.

The Navy will also undertake numerous actions in the course of managing natural resources on the Naval Air Weapons Station. These measures include but are not limited to:

1. Continuing the control of invasive species to reduce degradation of plant and wildlife habitats and to reduce the frequency of wildfires on the Naval Air Weapons Station.

2. Continuing to control of wild horses and feral burros on the Naval Air Weapons Station to better protect natural resources.

3. Undertaking plant and animal species surveys of the target and test site buffers, to support Navy activities that may affect desert tortoises.

4. Conducting post-project monitoring of certain activities that have the potential to affect federally listed species. The purpose of this monitoring is to ensure that avoidance and minimization measures have been properly implemented, to assess the effectiveness of these measures, and to allow for modifications to minimization measures, as needed.

Table 1 - Threats and Associated Activities of Proposed Actioin

		Driving off-road	Driving on road	Ground Disturbance	Explosions (potential for fire)	Weeds	Ravens	Moving desert tortoise from harm	Trained Personnel on foot	Habitat Conversion
Range Flight Operations	Desert tortoise	N	Y	Y	Y	N	N	N	N	N
	Critical Habitat	N	Y	Y	Y	N	N	N	N	N
Airfield Flight Operations	Desert tortoise	N	N	N	N	N	N	N	N	N
	Critical Habitat	N/A								
Range Ground Operations	Desert tortoise	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Critical Habitat	N	Y	Y	Y	Y	Y	Y	Y	Y
Directed Energy Operations	Desert tortoise	N	Y	N	Y	N	N	Y	Y	N
	Critical Habitat	N/A								
Ordnance Expenditures	Desert tortoise	Y	Y	Y	y	N	N	Y	Y	N
	Critical Habitat	Y	Y	Y	Y	N	N	Y	Y	N
Energetic Material Expenditures	Desert tortoise	Y	Y	Y	y	N	N	Y	Y	N
	Critical Habitat	Y	Y	Y	Y	N	N	Y	Y	N
Native American Uses	Desert tortoise	N	Y	N	N	N	N	N	N	N
	Critical Habitat	N/A								
Geothermal	Desert tortoise	N	Y	N	N	Y	Y	Y	Y	N
	Critical Habitat	N/A								
Research and Education	Desert tortoise	N	Y	N	N	N	N	Y	Y	N
	Critical Habitat	N/A								
Recreation	Desert tortoise	Y	Y	N	N	N	N	Y	Y	N
	Critical Habitat	N/A								
Feral Grazing Management	Desert tortoise	N	Y	Y	N	Y	N	Y	Y	N
	Critical Habitat	N	Y	Y	N	Y	N	Y	Y	N
Fire Management	Desert tortoise	N	Y	Y	N	N	N	Y	Y	N
	Critical Habitat	N	Y	Y	N	N	N	Y	Y	Y
Future Development	Desert tortoise	Y	Y	Y	Y	Y	Y	Y	Y	Y
	Critical Habitat	Y	Y	Y	Y	Y	Y	Y	Y	Y

Y = Associated activity may affect the desert tortoise or its critical habitat in this manner. (Activities would affect critical habitat and habitat not designated as critical in the same basic manner; however, we do not consider effects to non-critical habitat in assessing whether a proposed action is likely to destroy or adversely modify critical habitat.)

N = Associated activity does not affect the desert tortoise or its critical habitat.

N/A = Associated activity does not occur in area of concern (desert tortoise habitat or critical habitat)

Protective Measures

The Navy will continue to implement procedures designed to minimize impacts to desert tortoises. These procedures will ensure that potential impacts are minimized as much as possible, by being assessed during the project planning and approval process, and monitored for compliance and effectiveness. The Service and Navy revised the following measures from those included in the biological assessment during formal consultation:

1. The Navy will minimize incidental injury and mortality of desert tortoises by employing the following measures. Actual measures will be based on the results of site-specific field surveys and will be implemented, as needed, at the discretion of the Navy's environmental personnel (hereafter 'environmental staff'), including:

   a. Clearly delineating the boundaries of new construction or new target and test sites on the ground by flagging, survey lath, or wooden stakes;

b. Placing signs, as needed, to indicate the need to reduce speeds on roadways and that activities are to be strictly confined to the project site;

c. Biological monitoring of operations involved with the active removal of desert tortoise habitat known to be near the project site. Activities within existing test and target operations (operations including area preparation, target set-up, the actual test event and the target removal and site clean-up) would not require biological monitoring. The purpose of the biological monitoring is to ensure that avoidance and minimization measures have been properly implemented, to assess the effectiveness of these measures and to allow for modifications to minimization measures, as needed.

d. Placing desert tortoise-proof fences around projects or portions of projects in desert tortoise habitat where, the probability of injuring or killing a desert tortoise, without such fencing in place, is considered to be reasonably foreseeable.

2. Desert tortoise burrows located within 100 feet of the limits of construction or establishment of new target or test site boundaries will be protected by conducting additional on-site project personnel briefings (tailgate). If necessary, the Navy will either (1) place temporary (short-term) desert tortoise-proof fencing to completely enclose the burrow at a minimum distance of 20 feet from the burrow or, (2) for longer duration construction projects, fence the limits of construction to avoid any potential impacts to desert tortoise.

3. Desert tortoise burrows that cannot be avoided will be excavated by hand either by or under the direct supervision of an authorized biologist. Burrow excavation and subsequent handling of any desert tortoises will follow the most up-to-date guidelines that are acceptable to the Service.

4. The Navy will submit the credentials of personnel to be designated as authorized biologists to the Service at least 30 days prior to the onset of the activities to be monitored. The general qualifications and the request form are located on the Ventura Fish and Wildlife Office's website at http://www.fws.gov/ventura/species_information/protocols_guidelines/index.html.

5. All trash and debris will be promptly contained within containers that common ravens (*Corvus corax*) cannot access. These containers will be regularly removed from project sites to reduce the attractiveness of the area to common ravens and other desert tortoise predators.

6. Environmental staff will conduct awareness briefings for all personnel working in desert tortoise habitat. These briefings will be conducted either in person or via a video presentation of the briefing. At a minimum, the briefings will include discussions of:

a. the general provisions of the Endangered Species Act;

b. the necessity for adhering to the provisions of the Act, including both civil and criminal penalties for noncompliance. The penalties for these violations can be a maximum fine of up to $50,000 or imprisonment for one year, or both, and civil penalties of up to $25,000 per violation, may be assessed;

c. the potential for penalties associated with violating the provisions of the Act;

d. the specific requirements for complying with the provisions of the Act as they relate to each project;

e. the exact boundaries of the site within which the project activities may be accomplished;

f. the procedures to be accomplished by project personnel should any problem arise with respect to complying with environmental constraints;

g. general behavior and ecology of the desert tortoise; its sensitivity to human activities;

h. all personnel will be advised of the potential for desert tortoises to take refuge under vehicles and of the proper procedures to follow in that event; and

i. specific procedures to be followed to move a desert tortoise that may be in imminent danger (on a heavily traveled road, on an active project site, or under a vehicle).

7. To avoid impacts to desert tortoises during testing operations (including area preparation, target set up, the actual test event, and target removal or site clean-up) at test and target sites, Range personnel will make one final visual sweep of the target or test impact area to verify that desert tortoises are not present. Range personnel will remove any desert tortoises from eminent danger in accordance with procedures outlined in the Naval Air Weapons Station's awareness training. Range personnel will notify Environmental staff within 24 hours of removing any desert tortoise. The details of removals will be included in the annual reports submitted to the Service. Range personnel are not required to be Service authorized biologists to perform duties associated with this measure.

8. All personnel will check beneath their vehicles while in desert tortoise habitat prior to moving the vehicle. If a desert tortoise is found beneath the vehicle, it will be moved by environmental staff or by project personnel in accordance with guidelines provided to them during the awareness briefings. All personnel will be advised of the potential for desert tortoises to take refuge under vehicles and of the proper procedures to follow in that event. The Navy will report any removals of desert tortoises to the Service in its annual report.

9. The Navy will use adaptive fire management measures as a framework that recognizes biological uncertainty, while accepting a mandate to proceed on the basis of the best available scientific knowledge. As part of its fire management measures, the Navy will

continue to maintain its existing mutual aid fire-fighting agreements with other agencies (Bureau of Land Management, Forest Service, and County of San Bernardino) and continue to pursue the establishment of new mutual aid agreements. The Navy's goal is to contain all fires, while maintaining operational requirements, and safety and security of range personnel. To reduce the potential for impacts to threatened and endangered species, the Navy will employ the following measures:

a. Constructing firefighting equipment access roads (which may provide some utility as a fire break), on an as needed basis, in support of fire containment capabilities around targets. The Navy will use targets and the existing road network to determine where an access road may be prudent to prevent a fire from spreading into a roadless area. The utility of constructing access roads will be discussed with the Naval Air Weapons Station's Fire Department to determine where they would be useful to reduce the risk of fire and/or aid in fire suppression. The Navy will evaluate the benefits of constructing and maintaining access roads relative to both the economic and environmental cost. Access roads would be approximately 12 feet in width. The Navy will attempt to use areas naturally devoid of vegetation, including natural barriers such as washes and lava flows or existing roadways to minimize maintenance costs and impacts to native species.

b. Removing excessive vegetation (vegetation at a density that would sustain a fire) growth within the test and target areas, on an as needed basis to minimize the potential for a large, catastrophic wildfire as a result of range operations. Environmental staff will monitor the annual vegetation growth and work in conjunction with the Range and Fire Departments to determine when and where vegetation management is warranted.

c. The Navy will conduct post-fire surveys when fires leave the target area and enter adjoining critical habitat and document the date, time, location, cause, and acreage of the fire. Fires will be mapped using a global positioning system and plotted on a geographical information system.

d. In desert tortoise habitat, post-fire surveys will include focused surveys to determine if any desert tortoises have been injured or killed. The Navy will conduct the surveys in accordance with the desert tortoise pre-project survey guidelines (http://www.fws.gov/ventura/species_information/protocols_guidelines/index.html) and include the results in its annual report to the Service. An authorized biologist will lead the surveys.

e. The Navy will limit post-fire surveys to an annual cumulative acreage of 2,000 acres (1,000 acres in desert tortoise critical habitat and 1,000 acres in outside of desert tortoise critical habitat). The 2,000-acre limit is due to the practicality and logistical feasibility of conducting timely surveys over an area larger than 1,000 acres in both areas. In the instance of an unforeseen fire that exceeds this acreage, the Navy will consult with the Service as soon as possible.

10. The primary means to eliminate or minimize impacts to desert tortoises or their habitat will continue to be through the use of avoidance and minimization procedures. These methods include the following:

    a. To the extent possible, project sites will be selected so that they are located in previously disturbed areas.

    b. Surveys for desert tortoises will be accomplished for any project that occurs in potential habitat. Surveys will be conducted to support the analysis conducted under the National Environmental Policy Act, for new surface disturbing projects not analyzed in the record of decision for the legislative environmental impact statement for the land withdrawal, and where new disturbance may occur in desert tortoise habitat. Biologists will conduct surveys in accordance with the most current Service survey guidelines, except, surveys may be conducted year-round due to the short timelines associated with the Navy's activities.

    c. If new projects are located in desert tortoise habitat, environmental staff will, in conjunction with project proponents, attempt to reduce impacts by assessing the feasibility of adjusting a project's size, footprint, orientation, and construction method;

    d. If new projects have to be located where desert tortoises are known to occupy the project site, desert tortoises will be relocated by Service-authorized biologists prior to start of any activities. Authorized biologists are responsible for adhering to Service protocols and guidelines for handling and relocating desert tortoises.

    e. New land-disturbing activities that have occurred within habitats that support desert tortoises will continue to be documented in annual reports submitted to the Service.

11. The Navy will maintain coordination with Service and fulfill annual reporting requirement.

Future Development

Over the next 25 years, the Navy anticipates that 1,400 acres may be needed for new facilities, infrastructure, or new or expanded targets. In its biological assessment, the Navy estimates that 150 acres of new disturbance may occur within critical habitat and 1,250 acres may occur outside of critical habitat. The Navy estimates that the operation of the Naval Air Weapons Station could result in the mortality of up to four desert tortoises per year. The Navy also estimated the number of desert tortoises that may be harassed per year when animals are moved from harm's way. As we will discuss later in this biological opinion, we do not expect that moving desert tortoises from harm's way rises to the level where harassment, as defined in the Service's regulations (50 Code of Federal Regulations 17.3), occurs; consequently, we will not use the Navy's estimate in our analysis of the effects of the proposed action.

ANALYTICAL FRAMEWORK FOR THE JEOPARDY AND ADVERSE MODIFICATION DETERMINATIONS

Jeopardy Determination

Section 7(a)(2) of the Endangered Species Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of listed species. "Jeopardize the continued existence of" means to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 Code of Federal Regulations 402.02).

The jeopardy analysis in this biological opinion relies on four components: (1) the Status of the Species, which describes the range-wide condition of the desert tortoise, the factors responsible for that condition, and its survival and recovery needs; (2) the Environmental Baseline, which analyzes the condition of the desert tortoise in the action area, the factors responsible for that condition, and the relationship of the action area to the survival and recovery of the desert tortoise; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated or interdependent activities on the desert tortoise; and (4) the Cumulative Effects, which evaluates the effects of future, non-Federal activities in the action area on the desert tortoise.

In accordance with policy and regulation, the jeopardy determination is made by evaluating the effects of the proposed federal action in the context of the current status of the desert tortoise, taking into account any cumulative effects, to determine if implementation of the proposed action is likely to cause an appreciable reduction in the likelihood of both the survival and recovery of the desert tortoise in the wild.

Adverse Modification Determination

Section 7(a)(2) of the Endangered Species Act requires that Federal agencies ensure that any action they authorize, fund, or carry out is not likely to result in the destruction or adverse modification of critical habitat. This biological opinion does not rely on the regulatory definition of "destruction or adverse modification" of critical habitat at 50 Code of Federal Regulations 402.02. Instead, we have relied on the statutory provisions of the Act to complete the following analysis with respect to critical habitat.

In accordance with policy and regulation, the adverse modification analysis in this biological opinion relies on four components: (1) the Status of Critical Habitat, which describes the range-wide condition of designated critical habitat for the desert tortoise in terms of primary constituent elements, the factors responsible for that condition, and the intended recovery function of the critical habitat overall; (2) the Environmental Baseline, which analyzes the condition of the

critical habitat in the action area, the factors responsible for that condition, and the recovery role of the critical habitat in the action area; (3) the Effects of the Action, which determines the direct and indirect impacts of the proposed Federal action and the effects of any interrelated and interdependent activities on the primary constituent elements, and how that will influence the recovery role of the affected critical habitat units; and (4) Cumulative Effects, which evaluates the effects of future non-Federal activities in the action area on the primary constituent elements and how that will influence the recovery role of affected critical habitat units.

For purposes of the adverse modification determination, the effects of the proposed federal action on the critical habitat of the desert tortoise are evaluated in the context of the range-wide condition of the critical habitat, taking into account any cumulative effects, to determine if the critical habitat range-wide would remain functional (or would retain the current ability for the primary constituent elements to be functionally established in areas of currently unsuitable but capable habitat) to serve its intended recovery role for the desert tortoise.

STATUS OF THE SPECIES AND CRITICAL HABITAT

Status of the Desert Tortoise

Section 4(c)(2) of the Act requires the Service to conduct a status review of each listed species at least once every 5 years. The purpose of a 5-year review is to evaluate whether or not the *species' status has changed since it was listed (or since the most recent 5-year review); these* reviews, at the time of their completion, provide the most up-to-date information on the range-wide status of the species. For this reason, we are appending the 5-year review of the status of the desert tortoise (Appendix 1; Service 2010a) to this biological opinion and are incorporating it by reference to provide most of the information needed for this section of the biological opinion. The following paragraphs provide a summary of the relevant information in the 5-year review.

In the 5-year review, the Service discusses the status of the desert tortoise as a single distinct population segment and provides information on the Federal Register notices that resulted in its listing and the designation of critical habitat. The Service also describes the desert tortoise's ecology, life history, spatial distribution, abundance, habitats, and the threats that led to its listing (i.e., the 5-factor analysis required by section 4(a)(1) of the Endangered Species Act). In the 5-year review, the Service concluded by recommending that the status of the desert tortoise as a threatened species be maintained.

With regard to the status of the desert tortoise as a distinct population segment, the Service concluded in the 5-year review that the recovery units recognized in the original and revised recovery plans (Service 1994 and 2011a, respectively) do not qualify as distinct population segments under the Service's distinct population segment policy (61 Federal Register 4722; February 7, 1996). We reached this conclusion because individuals of the listed taxon occupy habitat that is relatively continuously distributed, exhibit genetic differentiation that is consistent

with isolation-by-distance in a continuous-distribution model of gene flow, and likely vary in behavioral and physiological characteristics across the area they occupy as a result of the transitional nature of, or environmental gradations between, the described subdivisions of the Mojave and Colorado deserts.

In the 5-year review, the Service summarizes information with regard to the desert tortoise's ecology and life history. Of key importance to assessing threats to the species and to developing and implementing a strategy for recovery is that desert tortoises are long-lived, require up to 20 years to reach sexual maturity, and have low reproductive rates during a long period of reproductive potential. The number of eggs that a female desert tortoise can produce in a season is dependent on a variety of factors including environment, habitat, availability of forage and drinking water, and physiological condition. Predation seems to play an important role in clutch failure. Predation and environmental factors also affect the survival of hatchlings.

In the 5-year review, the Service also discusses various means by which researchers have attempted to determine the abundance of desert tortoises and the strengths and weaknesses of those methods. The Service provides a summary table of the results of range-wide monitoring, initiated in 2001, in the 5-year review. This ongoing sampling effort is the first comprehensive attempt to determine the densities of desert tortoises across their range. Table 1 of the 5-year review provides a summary of data collected from 2001 through 2007; we summarize data from the 2008 through 2010 sampling efforts in subsequent reports (Service 2009, 2010c, 2010d). As the Service notes in the 5-year review notes, much of the difference in densities between years is due to variability in sampling; determining actual changes in densities will require many years of monitoring. Additionally, due to differences in area covered and especially to the non-representative nature of earlier sample sites, data gathered by the range-wide monitoring program cannot be reliably compared to information gathered through other means at this time.

In the 5-year review, the Service provides a brief summary of habitat use by desert tortoises; more detailed information is available in the revised recovery plan (Service 2011a). In the absence of specific and recent information on the location of habitable areas of the Mojave Desert, especially at the outer edges of this area, the 5-year review also describes and relies heavily on a quantitative, spatial habitat model for the desert tortoise north and west of the Colorado River that incorporates environmental variables such as precipitation, geology, vegetation, and slope and is based on occurrence data of desert tortoises from sources spanning more than 80 years, including data from the 2001 to 2005 range-wide monitoring surveys (Nussear et al. 2009). The model predicts the probability that desert tortoises will be present in any given location; calculations of the amount of desert tortoise habitat in the 5-year review and in this biological opinion use a threshold of 0.5 or greater predicted value for potential desert tortoise habitat. The model does not account for anthropogenic effects to habitat and represents the potential for occupancy by desert tortoises absent these effects.

To begin integrating anthropogenic activities and the variable risk levels they bring to different parts of the Mojave and Colorado deserts, the Service completed an extensive review of the threats known to affect desert tortoises at the time of their listing and updated that information with more current findings in the 5-year review. The review follows the format of the five-factor analysis required by section 4(a)(1) of the Act. The Service described these threats as part of the process of its listing (55 Federal Register12178; April 2, 1990), further discussed them in the original recovery plan (Service 1994), and reviewed them again in the revised recovery plan (Service 2011a).

To understand better the relationship of threats to populations of desert tortoises and the most effective manner to implement recovery actions, the Desert Tortoise Recovery Office is developing a spatial decision support system that models the interrelationships of threats to desert tortoises and how those threats affect population change. The spatial decision support system describes the numerous threats that desert tortoises face, explains how these threats interact to affect individual animals and habitat, and how these effects in turn bring about changes in populations. For example, we have long known that the construction of a transmission line can result in the death of desert tortoises and loss of habitat. We have also known that common ravens, known predators of desert tortoises, use the transmission line's pylons for nesting, roosting, and perching and that the access routes associated with transmission lines provide a vector for the introduction and spread of invasive weeds and facilitate increased human access into an area. Increased human access can accelerate illegal collection and release of desert tortoises and their deliberate maiming and killing, as well as facilitate the spread of other threats associated with human presence, such as vehicle use, garbage and dumping, and invasive plants (Service 2011a). Changes in the abundance of native plants because of invasive weeds can compromise the physiological health of desert tortoises, making them more vulnerable to drought, disease, and predation. The spatial decision support system allows us to map threats across the range of the desert tortoise and model the intensity of stresses that these multiple and combined threats place on desert tortoise populations.

The threats described in the listing rule and both recovery plans continue to affect the species. Indirect impacts to desert tortoise populations and habitat occur in accessible areas that interface with human activity. Most threats to the desert tortoise or its habitat are associated with human land uses; research since 1994 has clarified many mechanisms by which these threats act on desert tortoises. As stated earlier, increases in human access can accelerate illegal collection and release of desert tortoises and deliberate maiming and killing, as well as facilitate the spread of other threats associated with human presence, such as vehicle use, garbage and dumping, and invasive weeds.

Some of the most apparent threats to the desert tortoise are those that result in mortality and permanent habitat loss across large areas, such as urbanization and large-scale renewable energy projects, and those that fragment and degrade habitats, such as proliferation of roads and highways, OHV activity, and habitat invasion by non-native invasive plant species. However,

we remain unable to quantify how threats affect desert tortoise populations. The assessment of the original recovery plan emphasized the need for a better understanding of the implications of multiple, simultaneous threats facing desert tortoise populations and of the relative contribution of multiple threats on demographic factors (i.e., birth rate, survivorship, fecundity, and death rate; Tracy et al. 2004).

We have enclosed a map that depicts the 12 critical habitat units of the desert tortoise and the aggregate stress that multiple, synergistic threats place on desert tortoise populations (Appendix 2). The map also depicts linkages between conservation areas for the desert tortoise (which include designated critical habitat) recommended in the revised recovery plan (Service 2011a) that are based on an analysis of least-cost pathways (i.e., areas with the highest potential to support desert tortoises) between conservation areas for the desert tortoise. This map illustrates that areas under the highest level of conservation management for desert tortoises remain subjected to numerous threats and stresses. This indicates that current conservation actions for the desert tortoise are not substantially reducing mortality sources for the desert tortoise across its range.

Since the completion of the 5-year review, the Service has issued several biological opinions that affect large areas of desert tortoise habitat because of numerous proposals to develop renewable energy within its range. These biological opinions concluded that proposed solar plants were not likely to jeopardize the continued existence of the desert tortoise primarily because they were located outside of critical habitat and desert wildlife management areas that contain most of the land base required for the recovery of the species. The proposed actions also included numerous measures intended to protect desert tortoises during the construction of the projects, such as translocation of affected individuals. Additionally, the Bureau and California Energy Commission, the agencies permitting these facilities, have required the project proponents to fund numerous measures, such as land acquisition and the implementation of recovery actions intended to offset the adverse effects of the proposed actions. In aggregate, these projects resulted in an overall loss of approximately 30,180 acres of habitat of the desert tortoise; three of the projects (BrightSource Ivanpah, Stateline Nevada, and Desert Sunlight) constricted linkages between conservation areas that are important for the recovery of the desert tortoise. We also predicted that these projects would translocate, injure, or kill up to 1,621 desert tortoises (see table below); we concluded that most of the individuals in these totals would be juveniles. The mitigation required by the Bureau and California Energy Commission will result in the acquisition of private land within critical habitat and desert wildlife management areas and funding for the implementation of various actions that are intended to promote the recovery of the desert tortoise; at this time, we cannot assess how successful these measures will be.

The following table summarizes information regarding the proposed solar projects that have undergone formal consultation with regard to the desert tortoise. Data are from Service (2010d [Chevron Lucerne Valley], e [Calico], f [Genesis], g [Blythe]; 2011b [BrightSource Ivanpah], c [Desert Sunlight], d [Abengoa Harper Lake], e [Palen]; and Burroughs (2012; Nevada projects). Projects are in California, unless noted.

Project	Acres of Desert Tortoise Habitat	Estimated Number of Desert Tortoises Onsite	Recovery Unit
BrightSource Ivanpah	3,582	1,136	Eastern Mojave
Stateline Nevada - NV	2,966	123	Eastern Mojave
Amargosa Farm Road - NV	4,350	4	Eastern Mojave
Calico*			Western Mojave
Abengoa Harper Lake	Primarily in abandoned agricultural fields	4	Western Mojave
Chevron Lucerne Valley	516	10	Western Mojave
Nevada Solar One - NV	400	**	Northeastern Mojave
Copper Mountain North - NV	1,400	30 **	Northeastern Mojave
Copper Mountain - NV	380	**	Northeastern Mojave
Moapa K Road Solar - NV	2,152	202	Northeastern Mojave
Genesis	1,774	8	Colorado
Blythe	6,958	30	Colorado
Palen	1,698	18	Colorado
Desert Sunlight	4,004	56	Colorado
Total	30,180	1,621	

* The applicant has proposed changes to the proposed action; the Bureau has re-initiated formal consultation with the Service, pursuant to section 7(a)(2) of the Endangered Species Act, as part of its re-evaluation of the project (Service 2012c)

** These projects occurred under the Clark County Multi-species habitat conservation plan; we estimate that all three projects combined will affect fewer than 30 desert tortoises.

In addition to the biological opinions issued for solar development within the range of the desert tortoise, the Service (2012a) also issued a biological opinion to the Department of the Army for the use of additional training lands at Fort Irwin. As part of this proposed action, the Army removed approximately 650 desert tortoises from 18,197 acres of the southern area of Fort Irwin, which had been off-limits to training. The Army would also use an additional 48,629 acres that lie east of the former boundaries of Fort Irwin; much of this parcel is either too mountainous or too rocky and low in elevation to support numerous desert tortoises.

The Service also issued a biological opinion to the Marine Corps that considered the effects of the expansion of the Marine Corps Air Ground Combat Center at Twentynine Palms (Service 2012d). We concluded that the Marine Corps' proposed action, the use of approximately

167,971 acres for training, was not likely to jeopardize the continued existence of the desert tortoise. Most of the expansion area lies within the Johnson Valley Off-way Vehicle Management Area.

The incremental effect of the larger actions (i.e., solar development, the expansions of Fort Irwin and the Marine Corps Air Ground Combat Center) on the desert tortoise is unlikely to be positive, despite the numerous conservation measures that have been (or will be) implemented as part of the actions. The acquisition of private lands as mitigation for most of these actions increases the level of protection afforded these lands; however, these acquisitions do not create new habitat and Federal, State, and privately managed lands remain subject to most of the threats and stresses we discussed previously in this section. Although land managers have been implementing measures to manage these threats, we have been unable, to date, to determine whether the measures have been successful, at least in part because of the low reproductive capacity of the desert tortoise. Therefore, the conversion of habitat into areas that are unsuitable for this species continues the trend of constricting desert tortoise.

As the Service notes in the 5-year review (Service 2010a), "(t)he threats identified in the original listing rule continue to affect the (desert tortoise) today, with invasive species, wildfire, and renewable energy development coming to the forefront as important factors in habitat loss and conversion. The vast majority of threats to the desert tortoise or its habitat are associated with human land uses." Oftedal's work (2002 in Service 2010a) suggests that invasive weeds may adversely affect the physiological health of desert tortoises. Modeling with the spatial decision support system indicates that invasive species likely affect a large portion of the desert tortoise's range; see Appendix 3. Furthermore, high densities of weedy species increase the likelihood of wildfires; wildfires, in turn, destroy native species and further the spread of invasive weeds.

Global climate change is likely to affect the prospects for the long-term conservation of the desert tortoise. For example, predictions for climate change within the range of the desert tortoise suggest more frequent and/or prolonged droughts with an increase of the annual mean temperature by 3.5 to 4.0 degrees Celsius. The greatest increases will likely occur in summer (June-July-August mean increase of as much as 5 degrees Celsius [Christensen et al. 2007 in Service 2010a]). Precipitation will likely decrease by 5 to 15 percent annually in the region, with winter precipitation decreasing by up to 20 percent and summer precipitation increasing by 5 percent. Because germination of the desert tortoise's food plants is highly dependent on cool-season rains, the forage base could be reduced due to increasing temperatures and decreasing precipitation in winter. Although drought occurs routinely in the Mojave Desert, extended periods of drought have the potential to affect desert tortoises and their habitats through physiological effects to individuals (i.e., stress) and limited forage availability. To place the consequences of long-term drought in perspective, Longshore et al. (2003) demonstrated that even short-term drought could result in elevated levels of mortality of desert tortoises. Therefore, long-term drought is likely to have even greater effects, particularly given that the current fragmented nature of desert tortoise habitat (e.g., urban and agricultural development,

highways, freeways, military training areas, etc.) will make recolonization of extirpated areas difficult, if not impossible.

The Service notes in the 5-year review that the combination of the desert tortoise's late breeding age and a low reproductive rate challenges our ability to achieve recovery. When determining whether a proposed action is likely to jeopardize the continued existence of a species, we are required to consider whether the action would "reasonably be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species (50 Code of Federal Regulations 402.02). Although the Service does not explicitly address these metrics in the 5-year review, we have used the information in that document to summarize the status of the desert tortoise with respect to its reproduction, numbers, and distribution.

In the 5-year review, the Service notes that desert tortoises increase their reproduction in high rainfall years; more rain provides desert tortoises with more high quality food (i.e., plants that are higher in water and protein), which, in turn, allows them to lay more eggs. Conversely, the physiological stress associated with foraging on food plants with insufficient water and nitrogen may leave desert tortoises vulnerable to disease (Oftedal 2002 in Service 2010a), and the reproductive rate of diseased desert tortoises is likely lower than that of healthy animals. Young desert tortoises also rely upon high-quality, low-fiber plants (e.g., native forbs) with nutrient levels not found in the invasive weeds that have increased in abundance across its range (Oftedal et al. 2002; Tracy et al. 2004). Compromised nutrition of young desert tortoises likely represents an effective reduction in reproduction by reducing the number that reaches adulthood. Consequently, although we do not have quantitative data that show a direct relationship, the abundance of weedy species within the range of the desert tortoise has the potential to negatively affect the reproduction of desert tortoises and recruitment into the adult population.

Data from long-term study plots, which were first established in 1976, cannot be extrapolated to provide an estimate of the number of desert tortoises on a range-wide basis; however, these data indicate, "appreciable declines at the local level in many areas, which coupled with other survey results, suggest that declines may have occurred more broadly" (Service 2010a). Other sources indicate that local declines are continuing to occur. For example, surveyors found "lots of dead [desert tortoises]" in the western expansion area of Fort Irwin (Western Mojave Recovery Unit) in 2008 (Fort Irwin Research Coordination Meeting 2008). After the onset of translocation, coyotes killed 105 desert tortoises in Fort Irwin's southern translocation area (Western Mojave Recovery Unit); other canids may have been responsible for some of these deaths. Other incidences of predation were recorded throughout the range of the desert tortoise during this time (Esque et al. 2010). Esque et al. (2010) hypothesized that this high rate of predation on desert tortoises was influenced by low population levels of typical prey for coyotes due to drought conditions in previous years. Recent surveys in the Ivanpah Valley (Northeastern Mojave Recovery Unit) for a proposed solar facility detected 31 live desert tortoises and the carcasses of 25 individuals that had been dead less than 4 years (Ironwood 2011); this ratio of carcasses to

live individuals over such a short period of time may indicate an abnormally high rate of mortality for a long-lived animal. In summary, the number of desert tortoises range-wide likely decreased substantially from 1976 through 1990 (i.e., when long-term study plots were initiated through the time the desert tortoise was listed as threatened), although we cannot quantify the amount of this decrease. Additionally, more recent data collected from various sources throughout the range of the desert tortoise suggest that local declines continue to occur (e.g., Bureau et al. 2005, Esque et al. 2010).

The distribution of the desert tortoise has not changed substantially since the publication of the original recovery plan in 1994 (Service 2010a) in terms of the overall extent of its range. Prior to 1994, desert tortoises were extirpated from large areas within their distributional limits by urban and agricultural development (e.g., the cities of Barstow, Lancaster, Las Vegas, St. George, etc.; agricultural areas south of Edwards Air Force Base and east of Barstow), military training (e.g., Fort Irwin, Leach Lake Gunnery Range), and off-road vehicle use (e.g., portions of off-road management areas managed by the Bureau and unauthorized use in areas such as east of California City). Since 1994, urban development around Las Vegas has likely been the largest contributor to habitat loss throughout the range. Desert tortoises have been essentially removed from the 18,197-acre southern expansion area at Fort Irwin (Service 2012c).

The following table depicts acreages of habitat (as modeled by Nussear et al. 2009) within various regions of the desert tortoise's range and of impervious surfaces as of 2006 (Xian et al. 2009). Impervious surfaces include paved and developed areas and other disturbed areas that have zero probability of supporting desert tortoises.

Regions1	Modeled Habitat (acres)	Impervious Surfaces within Modeled Habitat	Percent of Modeled Habitat that is now Impervious
Western Mojave	7,582,092	1,864,214	25
Colorado Desert	4,948,900	494,981	10
Northeast Mojave	7,776,934	1,173,025	15
Upper Virgin River	232,320	80,853	35
Total	20,540,246	3,613,052	18

[1]The regions do not correspond to recovery unit boundaries; we used a more general separation of the range for this illustration.

On an annual basis, the Service produces a report that provides an up-to-date summary of the factors that were responsible for the listing of the species, describes other threats of which we are aware, describes the current population trend of the species, and includes comments of the year's findings. The Service's (2011f) recovery data call report describes the desert tortoise's status as 'declining,' and notes that "(a)nnual range-wide monitoring continues, but the life history of the desert tortoise makes it impossible to detect annual population increases (continued monitoring will provide estimates of moderate- to long-term population trends). Data from the monitoring

program do not indicate that numbers of desert tortoises have increased since 2001. The fact that most threats appear to be continuing at generally the same levels suggests that populations are still in decline. Information remains unavailable on whether mitigation of particular threats has been successful."

In conclusion, we have used the 5-year review (Service 2010a), revised recovery plan (Service 2011a), and additional information that has become available since these publications to review the reproduction, numbers, and distribution of the desert tortoise. The reproductive capacity of the desert tortoise may be compromised to some degree by the abundance and distribution of invasive weeds across its range; the continued increase in human access across the desert likely continues to facilitate the spread of weeds and further affect the reproductive capacity of the species. Prior to its listing, the number of desert tortoises likely declined range-wide, although we cannot quantify the extent of the decline; since the time of listing, data suggest that declines have occurred in local areas throughout the range. The continued increase in human access across the desert continues to expose more desert tortoises to the potential of being killed by human activities. The distributional limits of the desert tortoise's range have not changed substantially since the issuance of the original recovery plan in 1994; however, desert tortoises have been extirpated from large areas within their range (e.g., Las Vegas, other desert cities). The species' low reproductive rate, the extended time required for young animals to reach breeding age, and the multitude of threats that continue to confront desert tortoises combine to render its recovery a substantial challenge.

Status of Critical Habitat of the Desert Tortoise

The Service designated critical habitat for the desert tortoise in portions of California, Nevada, Arizona, and Utah in a final rule published February 8, 1994 (59 Federal Register 5820). The Service designates critical habitat to identify the key biological and physical needs of the species and key areas for recovery and to focus conservation actions on those areas. Critical habitat is composed of specific geographic areas that contain the biological and physical features essential to the species' conservation and that may require special management considerations or protection. These features, which include space, food, water, nutrition, cover, shelter, reproductive sites, and special habitats, are called the primary constituent elements of critical habitat. The specific primary constituent elements of desert tortoise critical habitat are: sufficient space to support viable populations within each of the six recovery units and to provide for movement, dispersal, and gene flow; sufficient quality and quantity of forage species and the proper soil conditions to provide for the growth of these species; suitable substrates for burrowing, nesting, and overwintering; burrows, caliche caves, and other shelter sites; sufficient vegetation for shelter from temperature extremes and predators; and habitat protected from disturbance and human-caused mortality.

Critical habitat of the desert tortoise would not be able to fulfill its conservation role without each of the primary constituent elements being functional. As examples, having a sufficient

amount of forage species is not sufficient if human-caused mortality is excessive; an area with sufficient space to support viable populations within each of the six recovery units and to provide for movement, dispersal, and gene flow would not support desert tortoises without adequate forage species.

The final rule for designation of critical habitat did not explicitly ascribe specific conservation roles or functions to the various critical habitat units. Rather, it refers to the strategy of establishing recovery units and desert wildlife management areas recommended by the recovery plan for the desert tortoise, which had been published as a draft at the time of the designation of critical habitat, to capture the "biotic and abiotic variability found in desert tortoise habitat" (59 Federal Register 5820, see page 5823). Specifically, we designated the critical habitat units to follow the direction provided by the draft recovery plan (Service 1993) for the establishment of desert wildlife management areas. The critical habitat units in aggregate are intended to protect the variability that occurs across the large range of the desert tortoise; the loss of any specific unit would compromise the ability of critical habitat as a whole to serve its intended function and conservation role.

Despite the fact that desert tortoises do not necessarily need to move between critical habitat units to complete their life histories, both the original and revised recovery plans highlight the importance of these critical habitat units and connectivity between them for the recovery of the species. Specifically, the revised recovery plan states that "aggressive management as generally recommended in the 1994 Recovery Plan needs to be applied within existing (desert) tortoise conservation areas (defined as critical habitat, among other areas being managed for the conservation of desert tortoises) or other important areas ... to ensure that populations remain distributed throughout the species' range .... (Desert tortoise) conservation areas capture the diversity of the Mojave population of the desert tortoise within each recovery unit, conserving the genetic breadth of the species, providing a margin of safety for the species to withstand catastrophic events, and providing potential opportunities for continued evolution and adaptive change .... Especially given uncertainties related to the effects of climate change on desert tortoise populations and distribution, we consider (desert) tortoise conservation areas to be the minimum baseline within which to focus our recovery efforts (pages 34 and 35, Service 2011a)."

The 12 critical habitat units range in area from 85 to 1,595 square miles. However, the optimal reserve size recommended to preserve viable desert tortoise populations was 1,000 square miles (Service 1994); only four critical habitat units meet this threshold. Consequently, for some smaller critical habitat units, their future effectiveness in conserving the desert tortoise is largely dependent on the status of populations immediately adjacent to their boundaries or within intervening linkages that connect these smaller critical habitat units to other protected areas. Although the Service (1994) recommended the identification of buffer zones and linkages for smaller desert tortoise conservation areas, land management agencies have generally not established such areas.

Population viability analyses indicate that reserves should contain from 10,000 to 20,000 adult desert tortoises to maximize estimated time to extinction (i.e., 390 years or so, depending on rates of population change; Service 1994). However, during the three most recent years of monitoring within the critical habitat units, only three (in 2009 and 2010) to five (in 2008) of the critical habitat units met this target (McLuckie et al. 2010; Service 2009, 2010b, 2010c). Some critical habitat units share boundaries and form contiguous blocks (e.g. Superior-Cronese and Fremont-Kramer Critical Habitat Units), and those blocks in California include combined estimated abundances of over 10,000 adult desert tortoises. These blocks are adjacent to smaller, more isolated units (e.g., Ord-Rodman Critical Habitat Unit) that are not currently connected to other protected habitat by preserved habitat linkages.

We did not designate the Desert Tortoise Natural Area and Joshua Tree National Park in California and the Desert National Wildlife Refuge in Nevada as critical habitat because they are "primarily managed as natural ecosystems" (59 Federal Register 5820, see page 5825) and provide adequate protection to desert tortoises. Since the designation of critical habitat, Congress increased the size of Joshua Tree National Park and created the Mojave National Preserve. A portion of the expanded boundary of Joshua Tree National Park lies within critical habitat of the desert tortoise; portions of other critical habitat units lie within the boundaries of the Mojave National Preserve.

Within each critical habitat unit, both natural and anthropogenic factors affect the function of the primary constituent elements of critical habitat. As an example of a natural factor, in some specific areas within the boundaries of critical habitat, such as within and adjacent to dry lakes, some of the primary constituent elements are naturally absent because the substrate is extremely silty; desert tortoises do not normally reside in such areas. Comparing the acreage of desert tortoise habitat as depicted by Nussear et al.'s (2009) model to the gross acreage of the critical habitat units demonstrates quantitatively that the entire area within the boundaries of critical habitat likely does not support the primary constituent elements; see the following table. The acreage for modeled habitat is for the area in which the probability that desert tortoises are present is greater than 0.5. The acreages of modeled habitat are from Service (2010b); they do not include loss of habitat due to human-caused impacts. The difference between gross acreage and modeled habitat is 653,214 acres; that is, approximately 10 percent of the gross acreage of the designated critical habitat is not considered modeled habitat.

Critical Habitat Unit	Gross Acreage	Modeled Habitat
Superior-Cronese	766,900	724,967
Fremont-Kramer	518,000	501,095
Ord-Rodman	253,200	184,155
Pinto Mountain	171,700	144,056
Piute-Eldorado	970,600	930,008
Ivanpah Valley	632,400	510,711
Chuckwalla	1,020,600	809,319
Chemehuevi	937,400	914,505
Gold Butte-Pakoon	488,300	418,189
Mormon Mesa	427,900	407,041
Beaver Dam Slope	204,600	202,499
Upper Virgin River	54,600	46,441
Totals	6,446,200	5,792,986

Condition of the Primary Constituent Elements of Critical Habitat

Human activities can have obvious or more subtle effects on the primary constituent elements. The grading of an area and subsequent construction of a building removes the primary constituent elements of critical habitat; this action has an obvious effect on critical habitat. The revised recovery plan identifies human activities such as urbanization and the proliferation of roads and highways as threats to the desert tortoise and its habitat; these threats are examples of activities that have a clear effect on the primary constituent elements of critical habitat.

We have included the following paragraphs from the revised recovery plan for the desert tortoise (Service 2011a) to demonstrate that other anthropogenic factors affect the primary constituent elements of critical habitat in more subtle ways. All references are in the revised recovery plan (i.e., in Service 2011a); we have omitted some information from the revised recovery plan where the level of detail was unnecessary for the current discussion.

> Surface disturbance from OHV activity can cause erosion and large amounts of dust to be discharged into the air. Recent studies on surface dust impacts on gas exchanges in Mojave Desert shrubs showed that plants encrusted by dust have reduced photosynthesis and decreased water-use efficiency, which may decrease primary production during seasons when photosynthesis occurs (Sharifi et al. 1997). Sharifi et al. (1997) also showed reduction in maximum leaf conductance, transpiration, and water-use efficiency due to dust. Leaf and stem temperatures were also shown to be higher in plants with leaf-surface dust. These effects may also impact desert annuals, an important food source for [desert] tortoises.
>
> OHV activity can also disturb fragile cyanobacterial-lichen soil crusts, a dominant source of nitrogen in desert ecosystems (Belnap 1996). Belnap (1996) showed that

> anthropogenic surface disturbances may have serious implications for nitrogen budgets in cold desert ecosystems, and this may also hold true for the hot deserts that [desert] tortoises occupy. Soil crusts also appear to be an important source of water for plants, as crusts were shown to have 53 percent greater volumetric water content than bare soils during the late fall when winter annuals are becoming established (DeFalco et al. 2001). DeFalco et al. (2001) found that non-native plant species comprised greater shoot biomass on crusted soils than native species, which demonstrates their ability to exploit available nutrient and water resources. Once the soil crusts are disturbed, non-native plants may colonize, become established, and out-compete native perennial and annual plant species (DeFalco et al. 2001, D'Antonio and Vitousek 1992). Invasion of non-native plants can affect the quality and quantity of plant foods available to desert tortoises. Increased presence of invasive plants can also contribute to increased fire frequency.
>
> Proliferation of invasive plants is increasing in the Mojave and Sonoran deserts and is recognized as a substantial threat to desert tortoise habitat. Many species of non-native plants from Europe and Asia have become common to abundant in some areas, particularly where disturbance has occurred and is ongoing. As non-native plant species become established, native perennial and annual plant species may decrease, diminish, or die out (D'Antonio and Vitousek 1992). Land managers and field scientists identified 116 species of non-native plants in the Mojave and Colorado deserts (Brooks and Esque 2002).
>
> Increased levels of atmospheric pollution and nitrogen deposition related to increased human presence and combustion of fossil fuels can cause increased levels of soil nitrogen, which in turn may result in significant changes in plant communities (Aber et al. 1989). Many of the non-native annual plant taxa in the Mojave region evolved in more fertile Mediterranean regions and benefit from increased levels of soil nitrogen, which gives them a competitive edge over native annuals. Studies at three sites within the central, southern, and western Mojave Desert indicated that increased levels of soil nitrogen can increase the dominance of non-native annual plants and promote the invasion of new species in desert regions. Furthermore, increased dominance by non-native annuals may decrease the diversity of native annual plants, and increased biomass of non-native annual grasses may increase fire frequency (Brooks 2003).

This summary from the revised recovery plan (Service 2011a) demonstrates how the effects of human activities on habitat of the desert tortoise are interconnected. In general, surface disturbance causes increased rates of erosion and generation of dust. Increased erosion alters additional habitat outside of the area directly affected by altering the nature of the substrate, removing shrubs, and possibly destroying burrows and other shelter sites. Increased dust affects photosynthesis in the plants that provide cover and forage to desert tortoises. Disturbed substrates and increased atmospheric nitrogen enhance the likelihood that invasive species will

become established and outcompete native species; the proliferation of weedy species increases the risk of large-scale fires, which further move habitat conditions away from those that are favorable to desert tortoises.

The following paragraphs generally describe how the threats described in the revised recovery plan affect the primary constituent elements of critical habitat of the desert tortoise.

Sufficient space to support viable populations within each of the six recovery units and to provide for movement, dispersal, and gene flow.

In considering the following discussion, bear in mind the information provided previously in this biological opinion regarding the recommended and actual sizes of critical habitat units for the desert tortoise. The original recovery team based the recommended size of desert wildlife management areas on the amount of space required to maintain viable populations. (The recovery plan [Service 1994] defined conservation areas for the desert tortoise as 'desert wildlife management areas;' we based the boundaries of critical habitat on the recovery team's general recommendation for the desert wildlife management areas.) The current low densities of desert tortoises within critical habitat units exacerbate the difficulties of effecting recovery within these areas.

Urban and agricultural development, concentrated use by off-road vehicles, and other activities of this nature completely remove habitat. Although we are aware of local areas within the boundaries of critical habitat that have been heavily disturbed, we do not know of any areas that have been disturbed to the intensity and extent that this primary constituent element has been compromised. To date, the largest single loss of critical habitat is the use of 18,197 acres of additional training land in the southern portion of Fort Irwin. In our biological opinion for that proposed action (Service 2012a), we stated:

> The proposed action would essentially eliminate the primary constituent elements from approximately 2.40 percent of the Superior-Cronese Critical Habitat Unit; additionally, the conservation role of the remainder of this critical habitat unit and the other critical habitat units has been compromised by substantial human impact on the second and sixth primary constituent elements. However, the protective measures that the Army implemented as part of the proposed action offset, at least to some extent, the adverse effects of the use of the additional training lands in the southern expansion area. Consequently, we have concluded that, although the second and sixth primary constituent elements are not functioning appropriately throughout most of designated critical habitat of the desert tortoise and the proposed action would result in substantial disturbance to 18,197 acres of the Superior-Cronese Critical Habitat Unit, the change in the condition of critical habitat brought about by the Army's proposed action (i.e., use of the southern

expansion area for training and implementation of the conservation actions) is not likely to cause an overall decrease in the conservation value and function of the Superior-Cronese Critical Habitat Unit.

The widening of existing freeways likely caused the second largest loss of critical habitat. Despite these losses of critical habitat, which occur in a linear manner, the critical habitat units continue to support sufficient space to support viable populations within each of the six recovery units.

In some cases, major roads likely disrupt the movement, dispersal, and gene flow of desert tortoises. Highways 58 and 395 in the Fremont-Kramer Critical Habitat Unit and Fort Irwin Road in the Superior-Cronese Critical Habitat Unit are examples of large and heavily travelled roads that likely disrupt movement, dispersal, and gene flow. Roads that have been fenced and provided with underpasses may alleviate this fragmentation to some degree; however, such facilities have not been in place for sufficient time to determine whether they will eliminate fragmentation.

The threats of invasive plant species described in the revised recovery plan generally do not result in the removal of this primary constituent element because they do not convert habitat into impervious surfaces, as would urban development.

Sufficient quality and quantity of forage species and the proper soil conditions to provide for the growth of these species.

This primary constituent element addresses the ability of critical habitat to provide adequate nutrition to desert tortoises. As described in the revised recovery plan and 5-year review, grazing, historical fire, invasive plants, altered hydrology, drought, wildfire potential, fugitive dust, and climate change/temperature extremes contribute to the stress of "nutritional compromise." Paved and unpaved roads through critical habitat of the desert tortoise provide avenues by which invasive native species disperse; these legal routes also provide the means by which unauthorized use occurs over large areas of critical habitat. Nitrogen deposition from atmospheric pollution likely occurs throughout all of the critical habitat units and exacerbates the effects of the disturbance of substrates. Because paved and unpaved roads are so widespread through critical habitat, this threat has compromised the conservation value and function of critical habitat throughout the range of the desert tortoise, to some degree. Appendix 3 depicts the routes by which invasive weeds have access to critical habitat; the routes shown on this map are a subset of the actual number of routes that actually cross critical habitat of the desert tortoise.

Suitable substrates for burrowing, nesting, and overwintering.

Surface disturbance, motor vehicles traveling off route, use of OHV management areas, OHV

events, unpaved roads, grazing, historical fire, wildfire potential, altered hydrology, and climate change leading to shifts in habitat composition and location, storms, and flooding can alter substrates to the extent that they are no longer suitable for burrowing, nesting, and overwintering. Erosion caused by these activities can alter washes to the extent that desert tortoise burrows placed along the edge of a wash, which is a preferred location for burrows, could be destroyed. We expect that the area within critical habitat that is affected by off-road vehicle use to the extent that substrates are no longer suitable is relatively small in relation to the area that desert tortoises have available for burrowing, nesting, and overwintering; consequently, off-road vehicle use has not had a substantial effect on this primary constituent element.

Most livestock allotments have been eliminated from within the boundaries of critical habitat. Of those that remain, livestock would compact substrates to the extent that they would become unsuitable for burrowing, nesting, and overwintering only in areas of concentrated use, such as around watering areas and corrals. Because livestock grazing occurs over a relatively small portion of critical habitat and the substrates in most areas within livestock allotments would not be substantially affected, suitable substrates for burrowing, nesting, and overwintering remain throughout most of the critical habitat units.

Burrows, caliche caves, and other shelter sites.

Human-caused effects to burrows, caliche caves, and other shelter sites likely occur at a similar rate as effects to substrates for burrowing, nesting, and overwintering for the same general reasons. Consequently, sufficient burrows, caliche caves, and other shelter sites remain throughout most of the critical habitat units.

Sufficient vegetation for shelter from temperature extremes and predators.

In general, sufficient vegetation for shelter from temperature extremes and predators remains throughout critical habitat. In areas where large fires have occurred in critical habitat, many of the shrubs that provide shelter from temperature extremes and predators have been destroyed; in such areas, cover sites may be a limiting factor. The proliferation of invasive plants poses a threat to shrub cover throughout critical habitat as the potential for larger and more frequent wildfires increases.

In 2005, wildfires in Nevada, Utah, and Arizona burned extensive areas of critical habitat (Service 2010a). Although different agencies report slightly different acreages, the following table provides an indication of the scale of the fires.

Critical Habitat Unit	Total Area Burned (acres)	Percent of the Critical Habitat Unit Burned
Beaver Dam Slope	53,528	26
Gold-Butte Pakoon	65,339	13
Mormon Mesa	12,952	3
Upper Virgin River	10,557	19

The revised recovery plan notes that the fires caused statistically significant losses of perennial plant cover, although patches of unburned shrubs remained. Given the patchiness with which the primary constituent elements of critical habitat are distributed across the critical habitat units and the varying intensity of the wildfires, we cannot quantify precisely the extent to which these fires disrupted the function and value of the critical habitat.

Habitat protected from disturbance and human-caused mortality.

In general, the Federal agencies that manage lands within the boundaries of critical habitat have adopted land management plans that include implementation of some or all of the recommendations contained in the original recovery plan for the desert tortoise. (See pages 70 to 72 of Service 2010a.) To at least some degree, the adoption of these plans has resulted in the implementation of management actions that are likely to reduce the disturbance and human-caused mortality of desert tortoises. For example, these plans resulted in the designation of open routes of travel and the closure (and, in some cases, physical closure) of unauthorized routes. Numerous livestock allotments have been relinquished by the permittees; cattle no longer graze these allotments. Because of these planning efforts, the Bureau's record of decision included direction to withdraw some areas of critical habitat from mineral entry. Because of actions on the part of various agencies, many miles of highways and other paved roads have been fenced to prevent desert tortoises from wandering into traffic and being killed. The Service and other agencies of the Desert Managers Group in California are implementing a plan to remove common ravens that prey on desert tortoises and to undertake other actions that would reduce subsidies (i.e., food, water, sites for nesting, roosting, and perching, etc.) that facilitate their abundance in the California Desert (Service 2008b).

Despite the implementation of these actions, disturbance and human-caused mortality continue to occur in many areas of critical habitat (which overlap the desert wildlife management areas for the most part and are the management units for which most data are collected) to the extent that the conservation value and function of critical habitat is, to some degree, compromised. For example, many highways and other paved roads in California remain unfenced. Twelve desert tortoises were reported to be killed on paved roads from within Mojave National Preserve in 2011, and we fully expect that desert tortoises are being killed at similar rates on many other

roads, although these occurrences are not discovered and reported as diligently as by the National Park Service. Employees of the Southern California Gas Company reported two desert tortoises in 2011 that were crushed by vehicles on unpaved roads.

Unauthorized off-road vehicle use continues to disturb habitat and result in loss of vegetation within the boundaries of critical habitat (e.g., Coolgardie Mesa in the Western Mojave Recovery Unit); although we have not documented the death of desert tortoises as a direct result of this activity, it likely occurs. Additionally, the habitat disturbance caused by this unauthorized activity exacerbates the spread of invasive plants, which displace native plants that are important forage for the desert tortoise, thereby increasing the physiological stress faced by desert tortoises.

Although the Bureau has approved, through its land use planning processes, the withdrawal of areas of critical habitat from mineral entry, it has not undertaken the administrative procedures to complete withdrawals in all areas. Absent this withdrawal, new mining claims can be filed and further disturbance of critical habitat could occur.

Finally, the Bureau has not allowed the development of solar power plants on public lands within the boundaries of its desert wildlife management areas (which largely correspond to the boundaries of critical habitat). Conversely, the County of San Bernardino is considering the approval of the construction and operation of at least two such facilities within the boundaries of the Superior-Cronese Critical Habitat Unit north of Interstate 15 near the Minneola Road exit.

Summary of the Status of Critical Habitat of the Desert Tortoise

As noted in the revised recovery plan for the desert tortoise and 5-year review (Service 2011a, 2010a), critical habitat of the desert tortoise is subject to landscape level impacts in addition to the site-specific effects of individual human activities. On the landscape level, atmospheric pollution is increasing the level of nitrogen in desert substrates; the increased nitrogen exacerbates the spread of invasive plants, which outcompete the native plants necessary for desert tortoises to survive. As invasive plants increase in abundance, the threat of large wildfires increases; wildfires have the potential to convert the shrubland-native annual plant communities upon which desert tortoises depend to a community with fewer shrubs and more invasive plants. In such a community, shelter and forage would be more difficult for desert tortoises to find. Invasive plants have already compromised the conservation value and function of critical habitat to some degree with regard to the second primary constituent element (i.e., sufficient quality and quantity of forage species and the proper soil conditions to provide for the growth of these species). These effects likely extend to the entirety of critical habitat, given the numerous routes by which invasive plants can access critical habitat and the large spatial extent that is subject to nitrogen from atmospheric pollution. Appendix 3 demonstrates the extent of the threat of invasive plants; Appendix 2 illustrates the 12 critical habitat units of the desert tortoise and the aggregate stress that multiple threats, including invasive plants, place on critical habitat.

Critical habitat has been compromised to some degree with regard to the last primary constituent element (i.e., habitat protected from disturbance and human-caused mortality) as a result of the wide variety of human activities that continues to occur within its boundaries. These effects result from the implementation of discrete human activities and are thus more site-specific in nature.

Although the remaining primary constituent elements have been affected to some degree by human activities, these impacts have not, to date, substantially compromised the conservation value and function of the critical habitat units. We have reached this conclusion primarily because the effects are localized and thus do not affect the conservation value and function of large areas of critical habitat.

Land managers have undertaken actions to improve the status of critical habitat. For example, as part of its efforts to offset the effects of the use of additional training maneuver lands at Fort Irwin (Service 2004), the Army acquired the private interests in the Harper Lake and Cronese Lakes allotments, which are located within critical habitat in the Western Mojave Recovery Unit; as a result, cattle have been removed from these allotments. Livestock have been removed from numerous other allotments through various means throughout the range of the desert tortoise. The retirement of allotments assists in the recovery of the species by eliminating disturbance to the primary constituent elements of critical habitat by cattle and range improvements.

ENVIRONMENTAL BASELINE

Description of the Action Area

The implementing regulations for section 7(a)(2) of the Act define the "action area" as all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 Code of Federal Regulations 402.02). We consider the action area to include the footprint of Naval Air Weapons Station, which consists of 1,095,680 acres.

Existing Conditions

The Naval Air Weapons Station is divided into the North and South Ranges, which are geographically separate areas. The North Range supports most of the Naval Air Weapons Station's infrastructure in its southern section, adjacent to the City of Ridgecrest. Much of the northern portion of the North Range lies at elevations that are higher than where desert tortoises normally occur. The South Range includes target areas in its southern portion and, in general, supports more desert tortoise habitat than the North Range.

The plant communities on the Naval Air Weapons Station vary from barren playas, alkali sink, saltbush scrub, and creosote bush scrub at lower elevations, to sagebrush scrub and pinyon

woodland found in the Coso and Argus ranges. Mojave mixed woody scrub is the most common plant community type, followed by creosote bush scrub.

Test and target facilities on the Naval Air Weapons Station account for 19,035 acres, with 13,106 acres in desert tortoise habitat (including 401 acres in desert tortoise critical habitat). Most areas that are repeatedly used for targets or tests are devoid of vegetation. Some paved roads and numerous unpaved roads cross the facility. Much of the Naval Air Weapons Station is undisturbed.

Previous Consultations in the Action Area

The Service (1991) issued a biological opinion to the Navy regarding the construction and operation of a landing strip in the Randsburg Wash area of the South Range. We concluded that the loss of 14.5 acres of habitat and the deaths of 3 desert tortoises over the life of the project were not likely to jeopardize the continued existence of the desert tortoise.

The Service (1992) issued a biological opinion to the Navy that considered the effects of ongoing activities at the Naval Air Weapons Station on the desert tortoise. This consultation established a set of protocols under which the Navy conducted its operations. We concluded that the proposed action, which we estimated would result in the deaths of 40 desert tortoises over time, was not likely to jeopardize the continued existence of the desert tortoise. The table in this section depicts numbers of desert tortoises that have been injured, killed, and moved from harm's way as a result of Navy activities (Navy 2012).

After the designation of critical habitat for the desert tortoise in 1994, the Service (1995) issued a biological opinion that considered the effects of ongoing activities at the Naval Air Weapons Station on critical habitat of the desert tortoise. This consultation evaluated the same set of protocols upon which the Navy and Service consulted in 1992. We concluded that the proposed action was not likely to result in the destruction or adverse modification of critical habitat.

The Service (2008a) issued a biological opinion to the Bureau of Land Management regarding the effects on the desert tortoise of the construction and operation of a water pipeline from the Coso Hay Ranch to the Coso geothermal area of the North Range at the Naval Air Weapons Station. The proposed action would cause the disturbance of approximately 17 acres of habitat within the boundaries of the Naval Air Weapons Station and 60 acres overall, although some of the disturbed area was not desert tortoise habitat. We concluded that few desert tortoises would be injured or killed by the proposed action. Because we could not provide a specific number of animals that would likely be injured or killed, we used the terms and conditions of the biological opinion to establish a re-initiation trigger; that is if more than 2 desert tortoises are killed or injured in any 12-month period by work associated with the Coso Hay Ranch pipeline project,

the Bureau of Land Management would need to re-initiate formal consultation. We concluded that the proposed action was not likely to jeopardize the continued existence of the desert tortoise.

The following table depicts the numbers of desert tortoises that have been injured, killed, and moved from harm's way as a result of Navy activities (Navy 2012). As in every action that covers a large area, we expect that the Navy did not detect all injuries and mortalities. Because the number of injured and dead desert tortoises was lower than the number moved from harm's way, we expect that the Navy's protective measures are generally functioning well and that few animals have died or been injured as a result of the Navy's activities. No desert tortoises were injured, killed, or moved from harm's way in 1996, 1997, 1999, 2001 through 2003, 2005 through 2008, and 2011 (Navy 2012).

	Number of Desert Tortoises			
Year	**Killed**	**Injured**	**Cause**	**Moved from Harm's Way**
1993	0	1	vehicle	1 from test site; 2 from roads
1994	0	0		6 from roads
1995	0	0		6 from roads
1998	1	0	vehicle	0
2004	1	0	rock quarry	0
2009	2	0	vehicle	2 from roads
2010	2	0	vehicle	12 from roads
Total	6	1		29

Status of Desert Tortoise in the Action Area

Kiva Biological Consulting (1991) conducted a relatively comprehensive survey and estimated the distribution and density of desert tortoise at the Naval Air Weapons Station. The surveyors walked 370 transects (each transect was 1.5 miles long by 10 yards wide. Kiva Biological Consulting concluded that the North Range supported 7 square miles of habitat that supported 21 to 50 desert tortoises per square mile and 129 square miles that supported fewer than 20 animals per square mile. On the South Range, Kiva Biological Consulting identified 30 square miles of habitat that supported 21 to 50 desert tortoises per square mile, 23.5 square miles of habitat that supported 20 animals per square mile, and 165.5 square miles of habitat that supported fewer than 20 animals per square mile.

Epsilon Systems Solutions, Inc. (2005) surveyed the Naval Air Weapons Station and concluded that the desert tortoise was widely distributed across the installation with relatively low abundance in most areas. Each of the ranges had three regions with estimated abundances of more than five desert tortoises per square mile. On the North Range, this included portions of Coso Basin, Baker Range, and Salt Wells; on the South Range, Superior Valley and the west and east ends of Pilot Knob Valley supported the highest densities.

The following table is based on information in Kiva Biological Consulting and Epsilon Systems Solutions, Inc. (2005).

Abundance Class (desert tortoises per square mile)	Square miles	Percentage of the Area
0-5	1,117	84.0
6-20	52	15.7
21-50	4.9	0.3
Total	1,173	

The results presented here seem to indicate that desert tortoises increased the area over which they are distributed on the Naval Air Weapons Station from 1991 to 2005 (354 square miles to 1,173). We expect that this change is an artifact of the way the surveyors reported their results rather than an increase in occupied habitat. That is, the 1,173 square miles may include areas where surveyors did not detect any desert tortoises or sign, whereas the 354 square miles may have excluded such areas.

The density of desert tortoises seems to have decreased between the times of the two surveys, based on the fact that Kiva Biological Consulting reported 37 square miles of densities in the 21 to 50 animals per square mile range in 1991 and Kiva Biological Consulting and Epsilon Systems Solutions reported 4.9 square miles of this density in 2005. Again, we expect that these numbers may not be precise; however, the decrease in the area occupied by higher densities of desert tortoises is consistent with results of other studies from throughout the Western Mojave Recovery Unit.

Status of Desert Tortoise Critical Habitat in the Action Area

A portion of the Superior-Cronese Critical Habitat Unit overlaps the southern portion of the South Range (Navy 2012). This area was in use as a target area at the time the Service designed critical habitat.

The Naval Air Weapons Station contains 89,310 acres of critical habitat of the desert tortoise; it is located along the southern boundary of the South Range. (See figure 4-1 in the biological assessment [Navy 2012]). The Navy did not provide information on the overall condition of the primary constituent elements of critical habitat within the boundaries of the Naval Air Weapons Station. In general, we expect that the condition of the primary constituent elements within the installation is similar to that within the remainder of the Superior-Cronese Critical Habitat Unit. That is, although we expect that the first, third, fourth, and fifth primary constituent elements have been affected to some degree by the Navy's activities, these impacts have not, to date, substantially compromised the conservation value and function of the critical habitat. We expect that invasive plants have compromised the conservation value and function of critical habitat to

some degree with regard to the second primary constituent element (i.e., sufficient quality and quantity of forage species and the proper soil conditions to provide for the growth of these species). Because most of the critical habitat within the Naval Air Weapons Station experiences fewer disturbances than public lands off base, we expect that the sixth primary constituent element (i.e., habitat protected from disturbance and human caused mortality) has not been appreciably affected by human activities.

The Navy's activities contribute to the less than prime condition of the second primary constituent element. Test and target sites occupy 401 acres of critical habitat (Navy 2012). Even though the Navy does not employ high explosives in these target areas, use of the target sites starts fires that spread to adjacent habitat. (The Navy uses 'spot charges,' which are similar to shotgun shells.) Between 1998 and 2011, the target areas in Superior Valley experienced 199 fires, burning 1091.7 acres (1.22 percent of the critical habitat in the action area). Half of these fires occurred in 2005; the remaining fires were clustered in the few subsequent years. The 2005 fires followed a winter of higher-than-average rainfall, which prompted heavy growth of non-native grasses that are extremely proficient at carrying wildfires. These fires kill native shrubs, upon which desert tortoises depend for shelter; consequently, fires also degrade the function and value of the fifth primary constituent element, which is 'sufficient vegetation for shelter from temperature extremes and predators.' Fires also foster the spread of non-native grasses, which outcompete the native annual plants upon which desert tortoises depend for nutrition, thereby further degrading the function and value of the second primary constituent element.

The following table depicts the number and size of fires within critical habitat on the Naval Air Weapons Station. We adapted the table from biological assessment (Navy 2012) to include only years in which fires occurred; the Navy notes that fires are mostly burning adjacent to targets and that at least some fires have likely burned the same areas more than once.

Year	Number of Fires	Acres Burned
1998	18	375
1999	1	7.6
2000	1	0.1
2005	101	70
2006	36	170
2007	31	18
2008	5	1
2011	6	450
Total	199	1,091.7

EFFECTS OF THE ACTION

As we described in the Description of the Proposed Action section of this biological opinion, the Navy and Service evaluated each of the Navy's proposed activities and listed the aspects of the activity that may affect desert tortoises or their habitat (including critical habitat). In this section

of the analysis, we will provide a general description of these various aspects that may affect desert tortoises and their habitat (including critical habitat).

The Navy (2012) anticipates that the development of new facilities, infrastructure, or new or expanded targets may require the disturbance of 150 acres within critical habitat and 1,250 acres outside of critical habitat. The Navy also estimates that the operation of the Naval Air Weapons Station could result in the mortality of up to four desert tortoises per year. These estimates provide the best available information on the scale and intensity of the Navy's activities over the next 25 years. Consequently, we will use these estimates as the basis for our analysis in this biological opinion.

Driving Off Roads

Desert Tortoise

In general, the use of vehicle off of roads (paved or unpaved) can injure or kill desert tortoises and trap them in their collapsed burrows. In contrast to recreational use, where numerous vehicles travel off road at high speeds and with little or no regard to natural resources, the Navy's use of vehicles off road would be limited to relatively infrequent circumstances and occur at low speeds; most use of vehicles off roads would also be monitored by staff that are trained to detect and avoid desert tortoises and their burrows. The off-road activities associated with range-ground operations and the expenditure of ordnance and energetic materials are expected to be infrequent (an average of once a month), for the purpose of retrieving misplaced materials (Campbell 2012). Consequently, we expect that use of vehicles off paved or unpaved roads is likely to injure or kill few desert tortoises.

Critical Habitat

In general, the use of vehicles off of roads (paved or unpaved) can destroy plants needed for cover and food, erode and compact substrates, cause proliferation of weeds, and increase in the number and location of wildfires. We do not expect that the use of vehicles off of roads, at the extent likely to be conducted by the Navy, would have a measurable effect on the first primary constituent element of critical habitat (sufficient space to support viable populations within each of the six recovery units and to provide for movement, dispersal, and gene flow). We have reached this conclusion because the Navy's use would be infrequent and monitored to the extent that it would not reduce the amount of habitat within critical habitat and prevent movement, dispersal, and gene flow.

The second through fifth primary constituent elements (sufficient quality and quantity of forage species and the proper soil conditions to provide for the growth of these species; suitable substrates for burrowing, nesting, and overwintering; burrows, caliche caves, and other shelter sites; sufficient vegetation for shelter from temperature extremes and predators) are related to the

biological and physical aspects of critical habitat. We expect the low level of use of vehicles off roads, which will be appropriately monitored, would not affect the function of these aspects of the desert tortoise's habitat in a measurable manner.

This aspect of the Navy's activities would minimally affect the sixth primary constituent element (habitat protected from disturbance and human caused mortality) because it would occur infrequently and be monitored.

Driving on Roads

Desert Tortoise

Although they are generally more easily observed on roads, vehicles often travel at high speeds, reducing the likelihood of drivers detecting and avoiding desert tortoises. Rises and turns in roads also decrease the ability of drivers to detect desert tortoises. Along heavily used roads, the number of desert tortoises is depressed for some distance from the edge of the road as a result of road-associated mortality; this distance varies with the level of use of the road. In general, vehicle use is likely to result in at least some mortalities of and injuries to desert tortoises; the extent of the loss is related to the condition of the road, the time of the year, the abundance of desert tortoises, and the awareness of the driver. Even the most careful drivers may occasionally strike a desert tortoise.

To date, vehicles striking tortoises on established roadways account for all but one of the reported mortalities in the action area. Additionally, personnel have moved many more from roadways. The Navy addresses this threat in its protective measures by posting signs for reduced speed limits where appropriate. We expect this threat to persist throughout the action area. The increase in tempo of operations may exacerbate the level of threat to desert tortoises.

Critical Habitat

The use of existing roads will not affect the second through fifth primary constituent elements because these physical and biological aspects of critical habitat are no longer present within roads. Roads that experience high levels of traffic can essentially form a barrier to movement, dispersal, and gene flow (first primary constituent element); we do not expect that any roads within the Naval Air Weapons Station within desert tortoise habitat experience this level of traffic. High levels of traffic may affect the sixth primary constituent element (habitat protected from disturbance and human caused mortality) by increasing the number of desert tortoises that are injured or killed; even with the expected increase in tempo of operations, we do not anticipate that traffic levels in desert tortoise habitat would rise to such levels.

Ground Disturbance

Desert Tortoise

We consider ground disturbance to include any activity where the Navy's activities disrupt vegetation and substrate through the use of heavy equipment and materials. Desert tortoises may be injured or killed or trapped in their burrows during these activities. Some of the Navy's activities that may cause negligible amounts ground disturbance; for example, the Navy's management of burros and wild horses would result in a limited amount of disturbance when animals are rounded up to be removed from the wild. Conversely, the construction of a new target or building may result in ground disturbance over a larger area.

Because the Navy would use standard and successful methods and experienced staff to avoid injuring or killing desert tortoises during ground-disturbing activities in desert tortoise habitat, we expect that relatively few desert tortoises are likely to be injured or killed as a result of ground disturbance.

Critical Habitat

Ground disturbance has the potential to adversely affect all the primary constituent elements of critical habitat. Small amounts of ground disturbance that are temporary in nature would generally affect critical habitat less than larger areas of permanent disturbance, although some indirect effects of smaller projects (e.g., the proliferation of weeds) can extend well beyond the temporal and spatial footprint of a project..

Explosions

Desert Tortoise

Ordnance or other material materials associated with explosions could strike a desert tortoise directly. Such events are likely extremely rare, given the large area of the target sites, the sparse distribution of desert tortoises, and the relatively small area that the explosion would affect. Additionally, the Navy's standard practice is to check areas before explosions occur and to remove desert tortoises. Some potential exists that large explosions can cause vibrations that would cause nearby burrows to collapse and trap desert tortoises inside.

Desert tortoises may be injured by noise associated with explosions. Bowles et al. (1999) found that subsonic and supersonic aircraft noise did not elicit substantial responses from desert tortoises. If a desert tortoise were close to a large explosion, however, we expect that the noise would have the potential to cause physical damage to the animal. Because the Navy inspects areas and would remove desert tortoises before explosions occur, few desert tortoises are likely to be injured or killed by explosions.

Given that use of the target sites can reasonably be expected to start fires under the appropriate conditions, we will consider these fires as a likely effect of explosions. Fires can injure or kill desert tortoises that are away from their burrows; the use of fire equipment to fight fires could also kill desert tortoises. Larger fires during times of the year and day when desert tortoises are active are more likely to injure or kill desert tortoises than smaller fires when desert tortoises are inactive (i.e., in their burrows). Desert tortoises are less likely to be present in areas that have repeatedly burned, where non-native grasses predominate; to the extent that at least some fires occur in such areas, the risk of desert tortoises being injured or killed by fire is somewhat reduced. The increase of the tempo of operations may result in a higher fire risk; however, the risk may not be proportionately the same because not all actions cause fires and the removal of non-native grasses by one fire may prevent subsequent fires in that area until the next growing season.

The Navy's fire management measures (primarily the removal of excessive vegetation around targets) are likely to reduce the potential for fires started at target sites. This measure is protective of desert tortoises because fires can kill desert tortoises that may be above ground.

Critical Habitat

The Navy's use of explosives would not directly impair the value and function of critical habitat with regard to the first primary constituent element (sufficient space to support viable populations within each of the six recovery units and to provide for movement, dispersal, and gene flow). We have reached this conclusion because the explosions occur in relatively small areas that are used repeatedly. Even with the increase in the tempo of operations, most explosions would likely occur in areas that have been previously used for such work. Indirectly, if a large fire spread from target sites, habitat conditions could be altered to the extent that desert tortoises would no longer traverse such areas.

Large explosions would likely alter the quality and quantity of forage species and the soil conditions to provide for the growth of these species in new target areas (the second primary constituent element); target areas that have been used previously likely no longer support these features. Smaller explosions likely have little or no direct effect on this primary constituent element. As we have discussed previously, fire spreading from a target area would likely reduce the value and function of this primary constituent element.

Large explosions likely damage substrates for burrowing, nesting, and overwintering (third primary constituent element) and burrows, caliche caves, and other shelter sites (fourth primary constituent element). Because most explosions would occur in previously used, defined target areas, damage to substrates and shelter sites is likely to be minimal. Fire may affect substrates and shelter sites if it removes sufficient plant cover to increase erosion during storm events. Large explosions would remove vegetation that desert tortoises use for shelter from temperature extremes and predators (the fifth primary constituent element), but generally in a limited area.

This adverse effect would be reduced by the use of existing target sites. Fire would affect shelter sites provided by shrubs if it spreads beyond the disturbed target site.

The repeated use of target sites would reduce the potential for explosions to have a measurable effect on the sixth primary constituent element (habitat protected from disturbance and human-caused mortality) because the disturbance and potential for mortality of desert tortoises would be limited to a relatively small portion of critical habitat. As with the other primary constituent elements, fire that spreads beyond disturbed areas around the target sites would increase the adverse effect.
The Navy's fire management measures (primarily the removal of excessive vegetation around targets) are likely to reduce the potential that fires started at target sites would have a measurable effect on the primary constituent elements of critical habitat of the desert tortoise.

Non-native Plant Species

Desert Tortoise

Vehicles, ground disturbance, fire, grazing by livestock and burros, and other human activities contribute to the dispersal of non-native plant species. These non-native plants include species that are already present in the California desert and newly introduced species. Non-native plants can alter the quality and quantity of plant foods available to desert tortoises and thereby affect their nutritional intake, as we discussed in the Status of the Species and Critical Habitat section of this biological opinion.

Critical Habitat

The spread of non-native plant species may impair the value and function of the first primary constituent element (sufficient space to support viable populations within each of the six recovery units and to provide for movement, dispersal, and gene flow) if they become so widespread and dense that reduce the ability of desert tortoises to forage over wide areas. This threat is most prominent in the action area where fires have the potential to alter habitat conditions on a large scale.

As we discussed in the Status of Critical Habitat of the Desert Tortoise in the Action Area section of this biological opinion, the function and value of the second primary constituent element (sufficient quality and quantity of forage species and the proper soil conditions to provide for the growth of these species) has been compromised to some degree throughout the range of the desert tortoise. The Navy's activities, particularly near targets where fires are more likely, may exacerbate this threat.
The spread of non-native plant species is not likely to affect the third and fourth primary constituent element (suitable substrates for burrowing, nesting, and overwintering; burrows, caliche caves, and other shelter sites). We have reached this conclusion because the plants would not generally affect substrates or shelter sites used by desert tortoises.

Non-native plant species can degrade vegetation that shelter desert tortoises use to seek shelter from temperature extremes and predators (the fifth primary constituent element), primarily by supporting larger and more intense fires. Most shrubs in the California desert are not adapted to fire. Once fire kills these shrubs, they are unlikely to return, thus depriving desert tortoises of shelter sites.

Habitat that is degraded by the presence of a large component of non-native species has not been protected from disturbance and human-caused mortality (the sixth primary constituent element). Consequently, spread of non-native plant species has the potential to further degrade the value and function of this primary constituent element.

The Navy's fire management measures (primarily the removal of excessive vegetation, which would likely consist primarily of non-native annual plants, around targets) has some potential to reduce the spread of non-native plant species. The success of this measure would depend greatly on the timing and method of removal. For example, removing the non-native grasses before they set seed would greatly reduce the ability of the plants to spread. Conversely, removing the grasses after seed has set would increase the likelihood that these plants would spread as wind and vehicles could disperse seeds widely from the target areas.

Common Ravens

Desert Tortoise

The Navy has proposed to manage its trash and debris to reduce the attractiveness of Naval Air Weapons Station to common ravens. This protective measure would likely be effective in reducing some level of food subsidies to common ravens. We expect that buildings and other structures on the Naval Air Weapons Station would continue to provide common ravens with more perching, roosting, and nesting sites than would be found in a natural setting. We also expect that common ravens also derive at least some food and water from the residential area of the installation. The increase in operational tempo may lead to an increase in the number of people using the residential area, which may, in turn, increase the amount of food and water available to common ravens. Any increase in the number of common ravens would likely result in increased predation of desert tortoises.

Critical Habitat

Common ravens do not affect the primary constituent element of critical habitat.

Moving Desert Tortoises from Harm's Way

Desert Tortoise

Some potential exists that capturing desert tortoises to move them from harm's way may cause elevated levels of stress that may render these animals more susceptible to disease. Because the Navy will use experienced biologists approved by the Service (or other Navy staff trained to handle desert tortoises) and approved handling techniques, collected desert tortoises are unlikely to experience elevated stress levels. Information from a translocation project at Fort Irwin indicates that translocation of desert tortoises in that study did not cause a measurable physiological stress response (Averill-Murray 2011). In the case of Fort Irwin, the animals were often moved far from their home ranges. Because the Navy's activities are of a smaller scale, desert tortoises moved from harm's way would likely remain within their home ranges; therefore, we expect that the potential for these animals to be stressed is even lower. Additionally, even if desert tortoises that are moved from harm's way undergo some level of stress, that effect would be temporary and less stressful than being killed.

Critical Habitat

Moving desert tortoises from harm's way will not affect critical habitat. Neither the desert tortoises themselves nor the workers who transport them will affect the primary constituent elements of critical habitat. If the workers construct artificial burrows, they will disturb limited areas where annual plants could grow and their supporting substrates; however, this disturbance will not measurably affect the primary constituent elements of critical habitat.

Personnel on Foot

Desert Tortoise

Because of their small size, hatchlings and slightly larger desert tortoises could be trampled by foot traffic. Nests are also vulnerable, but their typical location, near the mouth of a burrow, likely protects them to some degree.

We expect that few desert tortoises would be injured or killed in this manner because most Navy personnel working in desert tortoise habitat will receive specific training, which would increase their awareness of this potential threat. Additionally, the likelihood of stepping on desert tortoises is generally low because they are widely distributed and uncommon.

Critical Habitat

This activity will not affect the primary constituent elements of critical habitat because of the general low level and intensity of use.

Habitat Conversion

The Navy and Service listed habitat conversion as an aspect of its activities that may affect desert tortoises and their habitat (including critical habitat). After analyzing these aspects to this point in the biological opinion and in consideration of our discussion of future development, we have determined that the remainder of the Effects of the Action section of this biological opinion adequately discusses this issue. Consequently, we will not provide a specific analysis for this aspect of the Navy's activities.

Future Development

Desert Tortoise

Future development would likely include disturbance of habitat within habitat occupied by desert tortoises. Because the Navy's clients must conduct some activities with limited notice to the environmental staff at the Naval Air Weapons Station, biologists may conduct surveys for desert tortoise during months when desert tortoises are inactive; such surveys are highly unlikely to find all of the desert tortoises within the project area. If desert tortoises are not detected prior to ground-disturbing activities, they are more likely to be killed or injured. Conversely, many desert tortoises are killed by vehicles on roads; when activities are conducted while desert tortoises are spending most of their time in burrows, they are less likely to be at risk from vehicles.

Over the next 25 years, the Navy estimates that the operation of the Naval Air Weapons Station could result in the mortality of up to four desert tortoises per year. We do not know how many desert tortoises may occur in any given area where the Navy conducts activities, whether those desert tortoises will be active at the time of the activity (depending on the nature of the activity, active animals are more or less vulnerable than those that remain in their burrows), and the precise number of animals that would be detected and moved from harm's way (rather than being injured or killed) during the conduct of any activity, we cannot predict how many desert tortoises are likely to be injured or killed over the next 25 years. Additionally, the risk to desert tortoises would change as their numbers increase or decrease; we cannot predict this trend for the next 25 years. Because the Navy would re-initiate formal consultation if four desert tortoises are killed or injured in any given year, the Service will be able to reassess the level of mortality in relation to the number of desert tortoises on the Naval Air Weapons Station and within the Western Mojave Recovery Unit through subsequent biological opinions. Therefore, these future consultations would ensure that the level of mortality that may result from the Navy's activities does not exacerbate the overall threat to the viability of the species in the Western Mojave Recovery Unit.

For the aforementioned reasons, we will base our analysis regarding the intensity of the Navy's activities with respect to desert tortoises on the estimate that up to four desert tortoises are likely

to be killed each year. (We will not discuss injury in this section; we will assume that any injured desert tortoises that are found will be treated. If they recover from their injuries to the extent that they can be released to the wild, these animals would not be included in the annual count of dead desert tortoises.) The Navy has never recorded more than two dead desert tortoises per year; given this fact and the proposed increase in the tempo of operations, we consider four desert tortoise mortalities per year to be a reasonable estimate. We also note that the Navy is unlikely to find every desert tortoise that dies as a result of its activities.

Because the Navy's activities would occur over a large area, a reasonable conclusion is that desert tortoises killed by those activities would occur over a large area. In areas of extremely low densities, even a few mortalities could substantially reduce the likelihood that desert tortoises would persist over the long term, as reproduction would decline if they cannot find mates. The effects of reproduction would decrease in areas with more desert tortoises, although the Naval Air Weapons Station does not support any areas with densities comparable to those found prior to its listing.

The Navy anticipates that 1,250 acres outside of critical habitat may be needed for the development of new facilities, infrastructure, and new or expanded targets. As previously discussed in this biological opinion, different surveyors estimated the amount of desert tortoise habitat on the Naval Air Weapons Station area at 354 to 1,173 square miles. For the sake of this analysis, we will assume that the entire installation supports 354 square miles of desert tortoise habitat and that the entire area of critical habitat within the installation is suitable habitat for desert tortoises. Therefore, approximately 214 square miles of desert tortoise habitat occur within the Naval Air Weapons Station outside of critical habitat. (That is, 354 square miles base-wide minus 89,310 acres of critical habitat divided by 640 equals 140 square miles; 354 – 140 = 214.)

Consequently, the 1.9 square miles (1,250 acres divided by 640 equals 1.9 square miles) that the Navy anticipates may be developed over the next 25 years comprises approximately 0.89 percent of the available habitat on the Naval Air Weapons Station. This development would be scattered in numerous locations through desert tortoise habitat. We expect that this loss of habitat is not likely to affect the distribution of the desert tortoise in a measurable manner.

Critical Habitat

The Navy anticipates that up to 150 acres may be needed for the development of new facilities, infrastructure, and new or expanded targets within the boundaries of critical habitat. This acreage comprises approximately 0.17 percent of the critical habitat on the Naval Air Weapons Station and 0.02 percent of the Superior-Cronese Critical Habitat Unit. (That is, 150 acres of development divided by 89,310 acres of critical habitat on the Naval Air Weapons Station times 100 equals 0.17 percent; 150 acres of development divided by 766,900 acres of critical habitat within the Superior-Cronese Critical Habitat Unit times 100 equals 0.02 percent.)

As we discussed in the previous section, the 150 acres of development would likely be scattered throughout critical habitat. We have previously discussed how the various aspects of the Navy's activities would affect the primary constituent elements of critical habitat, so we will not repeat those analyses here. Given, however, that the first primary constituent element (sufficient space to support viable populations within each of the six recovery units and to provide for movement, dispersal, and gene flow) specifically addresses the spatial aspects of critical habitat, we will discuss the navy's estimate in this context.

The loss or disturbance of relatively small amount of critical habitat over the next 25 years of operations, even when considered in combination with the approximately 1,100 acres that have burned to date, would not measurably impair the value and function of this primary constituent element. This loss or disturbance would increase the patchiness of suitable habitat because it would occur in numerous locations throughout critical habitat but it would occupy a very small area.

Effects on Recovery

The North Range is located in an area that the Service does not consider important to the long-term conservation of the desert tortoise, either as a key area to maintain a population of desert tortoises or as a linkage between such areas. The southern portion of the South Range lies within the Superior-Cronese Critical Habitat Unit. Because the Navy has traditionally focused most of its activities in the North Range and has proposed to limit its activities to a degree within critical habitat, implementation of the proposed action will not measurably affect the recovery of the desert tortoise.

Summary of the Effects of the Proposed Action on the Desert Tortoise and its Critical Habitat

Desert Tortoise

The regulatory definition of "to jeopardize the continued existence of the species" focuses on how the proposed action would affect the reproduction, numbers, or distribution of the species being considered in the biological opinion. For that reason, we have used those aspects of the desert tortoise's status as the basis to assess the overall effect of the proposed action on the species.

The mortality of four desert tortoises per year over the 25-year life of the withdrawal may negatively affect the amount of reproduction that can occur within the Naval Air Weapons Station, primarily because the loss of even a small number of individuals in a low-density population renders finding mates even more difficult. Within the context of desert tortoises across the Western Mojave Recovery Unit, these effects on reproduction would not be

measurable, primarily because the desert tortoises within the Naval Air Weapons Station comprise a relatively small proportion of the overall population in this recovery unit.

In its report on the results of range-wide sampling for 2010, the Service (2010b, 2010c) estimated that 8,301 larger desert tortoises (i.e., those greater than 180 millimeters in length) occupied the Superior-Cronese Desert Wildlife Management Area. Because of the sampling method, this number does not include desert tortoises smaller than 180 millimeters; consequently, the desert wildlife management area supports more than 8,301 desert tortoises. Additionally, the Western Mojave Recovery Unit covers a larger area than the Superior-Cronese Desert Wildlife Management Area; this larger area would include even more desert tortoises. Consequently, the loss of four desert tortoises per year that would trigger re-initiation of formal consultation comprises a minute portion of the overall number of desert tortoises in the Western Mojave Recovery Unit.

We cannot predict how the overall number of desert tortoises in the Western Mojave Recovery Unit may change over the next 25 years. If the overall number of desert tortoises in the recovery unit decreases, we expect that the number of desert tortoises that inhabit the Naval Air Weapons Station would also decrease; in that case, the likelihood that individuals would be encountered and killed during any given action by the Navy would also decrease. If the number of desert tortoises within the boundaries of the Naval Air Weapons Station increased, the re-initiation trigger would remain constant at four individuals per year. In the first case, the overall loss of desert tortoises in the Western Mojave Recovery Unit would remain at a constant small portion of the population; in the latter case, the portion of the population that would be lost would continue to shrink as the overall number of desert tortoises increased. In either case, the mortality of four desert tortoises per year as a result of the Navy's activities at the Naval Air Weapons Station would not comprise an appreciable reduction in the number of desert tortoises in the Western Mojave Recovery Unit.

The long-term disturbance of 1,400 acres associated with the proposed action would not appreciably reduce the distribution of the desert tortoise. Based on the Nussear et al. (2009) model and our calculations (Waln 2010), the Western Mojave Recovery Unit may support as much as 10,316 square miles of desert tortoise habitat. Consequently, the proposed action would result in the loss of approximately 0.02 percent of the habitat in the Western Mojave Recovery Unit; the disturbed lands would be scattered in numerous parcels across the Naval Air Weapons Station.

Critical Habitat

The proposed action will not reduce the conservation role and function of critical habitat because most of the disturbance proposed by the Navy would occur outside of the boundaries of critical habitat. The Navy has proposed to disturb only approximately 0.02 percent of the Superior-Cronese Critical Habitat Unit. The Navy's proposal to adaptively manage fire around target sites

is likely to reduce the level of effects of its actions within critical habitat.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, tribal, local or private actions that are reasonably certain to occur in the action area considered in this biological opinion. Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the Act. Because the action area is entirely located on Federal lands, all future actions will be subject to the consultation requirements of section 7(a)(2) of the Act. Consequently, the proposed action has no associated cumulative effects.

CONCLUSION

Desert Tortoise

After reviewing its current status, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the proposed action is not likely to jeopardize the continued existence of the desert tortoise. We have reached this conclusion, in part, because the Navy has proposed measures to reduce the number of desert tortoises that are likely to be injured or killed by its proposed action. Additionally, most of the habitat within the Naval Air Weapons Station supports low densities of desert tortoises and the Navy's activities will likely disturb a small portion of occupied habitat within the installation.

The analysis we conduct under section 7(a)(2) of the Endangered Species Act must be conducted in relation to the status of the entire listed taxon. We based the analysis in this biological opinion within the context of the Western Mojave Recovery Unit because of the wide range of the desert tortoise. Because we have determined that the effects of this action would not compromise the integrity of the Western Mojave Recovery Unit or impede the survival or recovery of the desert tortoise in an appreciable manner in this portion of its range, we have not extended the analysis of the effects of this proposed action to the remainder of the range of the Mojave population of the desert tortoise.

Critical Habitat

After reviewing the current status of critical habitat, the environmental baseline for the action area, the effects of the proposed action, and the cumulative effects, it is our biological opinion that the proposed action is not likely to result in the destruction or adverse modification of critical habitat of the desert tortoise. We have reached this conclusion because the amount of critical habitat that is likely to be affected comprises a small portion of the total amount of the critical habitat on the Naval Air Weapons Station, which itself is a portion of the larger Superior-

Cronese Critical Habitat Unit. The amount of disturbance is not likely to compromise the conservation function and value of critical habitat for the desert tortoise.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened wildlife species, respectively, without special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harm is further defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to wildlife by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with the protective measures proposed by the Navy and the terms and conditions of this incidental take statement.

The measures described below are non-discretionary. The Navy must undertake these measures or make them binding conditions of any grant or permit issued to its customers, as appropriate, for the exemption in section 7(o)(2) to apply. The Navy has a continuing duty to regulate the activity covered by this incidental take statement. If the Navy fails to assume and implement the terms and conditions of the incidental take statement or to make them binding conditions of its customers' grants or permits, the protective coverage of section 7(o)(2) may lapse. To monitor the impact of incidental take, the Navy must report the progress of the action and its impact on the desert tortoise to the Service as specified in the incidental take statement. [50 CFR 402.14(i)(3)]

We estimate that four desert tortoises per year are likely to be taken, in the form of mortality, as a result of the proposed operation of the Naval Air Weapons Station. This number is based on the estimate provided by the Navy in its biological assessment (Navy 2012); we used this estimate as the basis of our section 7(a)(2) analysis in this biological opinion. Based on the 25-year life of the withdrawal, we anticipate that 100 desert tortoises are likely to be killed.

Because we do not expect that removing desert tortoises from harm's way is likely to result in injury or mortality of desert tortoises, we are not anticipating the amount or extent of this form of take.

REASONABLE AND PRUDENT MEASURES AND TERMS AND CONDITIONS

The Navy and Service agreed to several revisions to the proposed action during the course of formal consultation. Because these revisions have been incorporated into the proposed action of this biological opinion, we have no additional reasonable and prudent measures or terms and conditions.

As described at the beginning of this section, the protective coverage of section 7(o)(2) may lapse if the Navy does not abide by the protective measures described in this biological opinion. Additionally, the Navy remains responsible for complying with the provisions of Reporting Requirements and Disposition of Dead or Injured Specimens sections of this biological opinion.

REPORTING REQUIREMENTS

Pursuant to 50 Code of Federal Regulations 402.14(i)(3), the Navy must provide a report to the Service that provides details on each desert tortoise that is killed or injured by its activities. Specifically, the report must include information on any instances when desert tortoises were killed, injured, or handled, the circumstances of such incidents, and any actions undertaken to prevent similar instances from re-occurring. The report must also include a description of the monitoring efforts that occurred during implementation of its proposed action. We recommend that the Navy provide this report by January 31 of each year this biological opinion is in effect; however, the Navy may suggest an alternative date for reporting, if it so desires.

DISPOSITION OF DEAD OR INJURED SPECIMENS

Within 3 days of locating any dead or injured desert tortoises, you must notify the Ventura Fish and Wildlife Office by telephone (805 644-1766) and by facsimile (805 644-3958) or electronic mail. The report must include the date, time, and location of the carcass, a photograph, cause of death, if known, and any other pertinent information.

The Navy must take injured desert tortoises to a qualified veterinarian for treatment. If any injured desert tortoises survive, the Navy must contact the Service regarding their final disposition.

The Navy must take care in handling dead specimens to preserve biological material in the best possible state for later analysis, if such analysis is needed. The Service will make this determination when the Navy provides notice that a desert tortoise has been killed by project activities.

CONSERVATION RECOMMENDATIONS

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes

of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information.

1. We recommend that the Navy conduct focused surveys in the riparian portion of the North Range, to assess the status of willow flycatchers and Bell's vireos in the action area.

2. We recommend that the Navy conduct surveys of desert tortoise critical habitat in the action area, to more accurately assess the status of desert tortoise in the area. This information can function as new baseline data and may facilitate more effective management practices.

3. We recommend that the Navy participate in recovery actions for the desert tortoise that are intended to increase the number of animals and secure its habitat, both within and outside the boundaries of the Naval Air Weapons Station. Such programs could include assisting the Service in implementation of the management plan for the common raven, control of feral dogs, management of subsidies for coyotes, and numerous other activities that are intended to reduce the mortality levels of desert tortoises and improve habitat conditions.

The Service requests notification of the implementation of any conservation recommendations so we may be kept informed of actions minimizing or avoiding adverse effects or benefitting listed species or their habitats.

RE-INITIATION NOTICE

This concludes formal consultation on the actions outlined in the proposed renewal of the Navy's public land withdrawal of the Naval Air Weapons Station. Re-initiation of formal consultation is required where discretionary Federal involvement or control over the action has been retained or is authorized by law and: (a) if the amount or extent of taking specified in the incidental take statement is exceeded; (b) if new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (c) if the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion; or (d) if a new species is listed or critical habitat designated that may be affected by the identified action (50 Code of Federal Regulations 402.16).

In instances where the amount or extent of incidental take is exceeded, the exemption issued pursuant to section 7(o)(2) will have lapsed and any further take would be a violation of section 4(d) or 9. Consequently, we recommend that any operations causing such take cease pending re-initiation.

Sincerely,

Diane K. Noda

Diane K. Noda
Field Supervisor

Appendices

1 - Mojave population of the desert tortoise (*Gopherus agassizii*). 5-year review: summary and evaluation. Available on disk or hard copy by request or at http://ecos.fws.gov/docs/five_year_review/doc3572.DT%205Year%20Review_FINAL.pdf.

2 - Map illustrating the 12 critical habitat units of the desert tortoise and the aggregate stress that multiple threats place on critical habitat.

3 - Map depicting the extent of the threat of invasive plants

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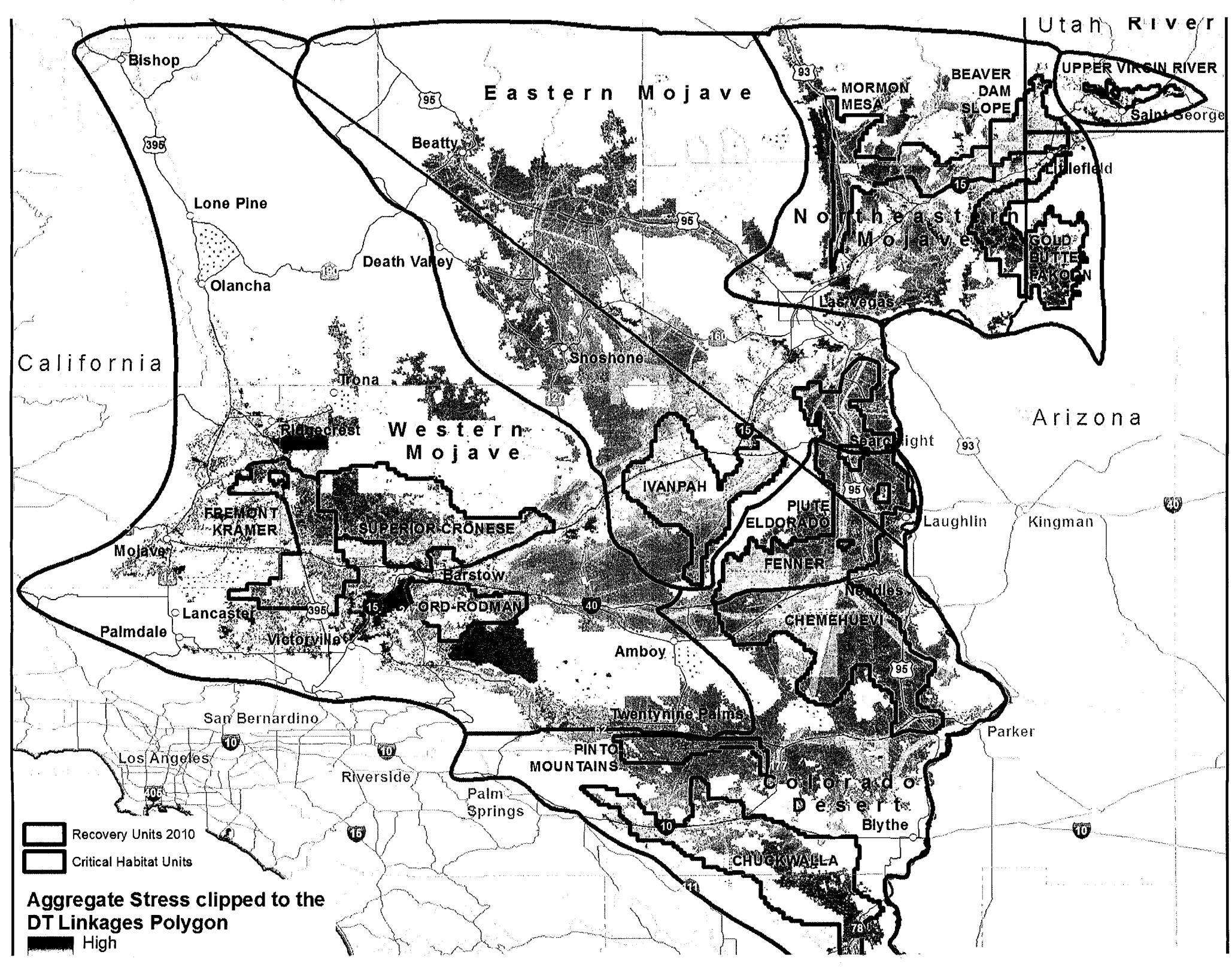
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Northeastern Mojave
GOLD BUTTE
PAKOON
Las Vegas
California
Shoshone
Irona
Ridgecrest
Western Mojave
Arizona
Searchlight
IVANPAH
PIUTE
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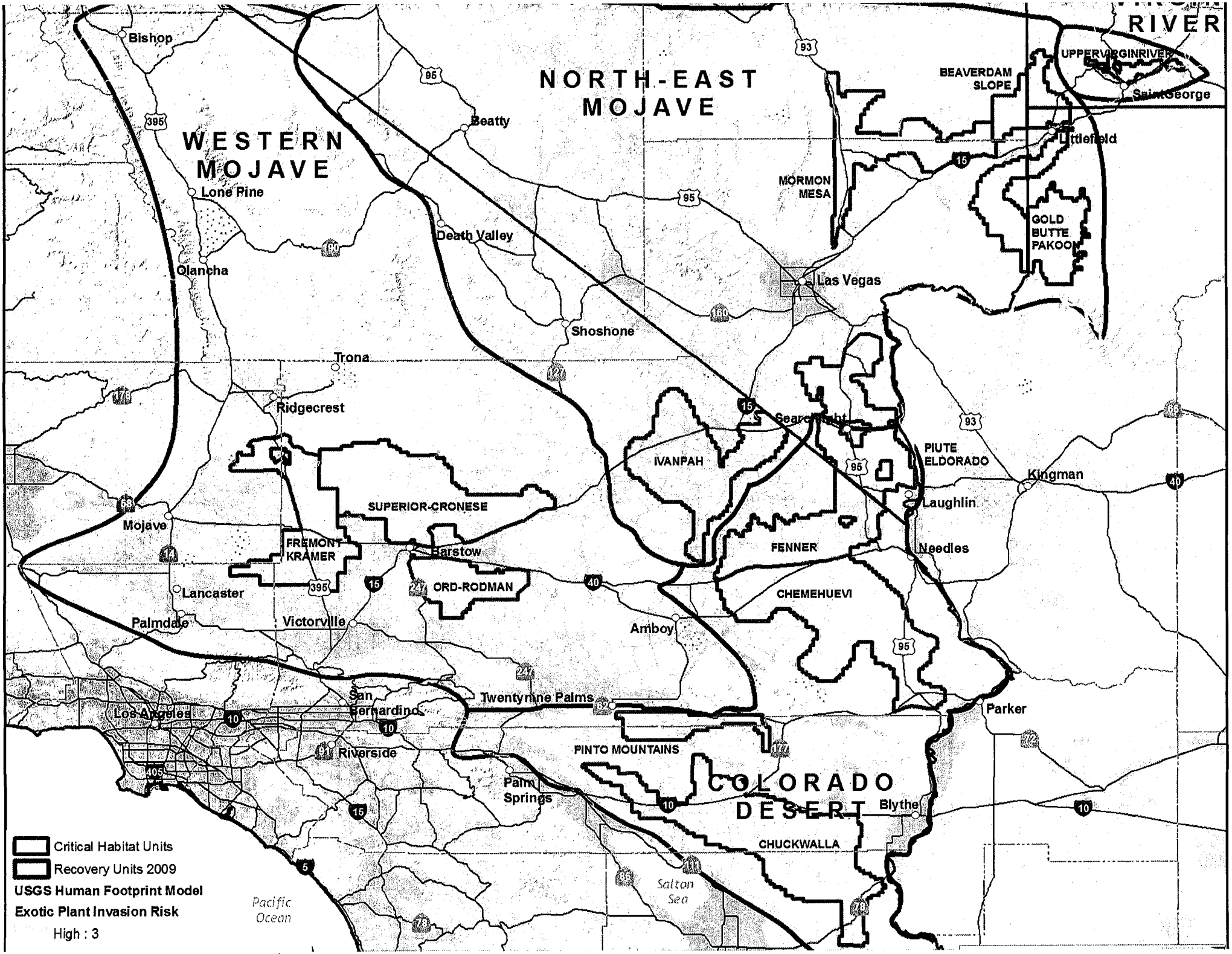
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USGS Human Footprint Model
Exotic Plant Invasion Risk
High : 3

DEPARTMENT OF THE NAVY
NAVAL WEAPONS CENTER
CHINA LAKE, CALIFORNIA 93555-6001

IN REPLY REFER TO:
10570
Ser 0082/13102
16 Oct 90

Mr. Peter Stine
U.S. Fish and Wildlife Service
2140 Eastman Avenue, Suite 100
Ventura, CA 93003

Dear Mr. Stine:

Every few years it is necessary to carry out willow trimming maintenance along the roadside in Mountain Springs Canyon as a safety measure for vehicular traffic in this area. This canyon is habitat to the federally listed Inyo California towhee (Pipilo crissalis eremophilus) and the willows are an important component of this species habitat.

Trimming is conducted by Public Works (Code 26) employees, during the non-growing season, who trim only to the extent marked by biologists from the Environmental Project Office (Code 0082), usually not more than 2 or 3 feet from the roadway into the bulk of the tree. The linear totality of this maintenance encompasses less than 100 meters. These same biologists monitor the trimming after it is accomplished.

It is our determination that this program has no effect on the Inyo brown towhee or its habitat beyond the very temporary interruption during the actual cutting. As it is our plan to carry out trimming during the fall of 1990, we would appreciate your concurrence at your earliest convenience.

If there are any problems or if you have any questions, please call Ms. everly Kohfield, wildlife biologist at (619) 939-3411, extension 382.

Jerry R Boggs

JERRY R. BOGGS
Head, Environmental Resources Branch
Environmental Project Office
By direction of the Commander

Blind copy to:
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008
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0082 (2)
2152

Writer: B. Kohfield, 0082, 3411 X382
Typist: E. Marquez, 2790, 9 Oct 90
Retyped: E. Marquez, 2790, 15 Oct 90

DEPARTMENT OF THE NAVY
NAVAL WEAPONS CENTER
CHINA LAKE, CALIFORNIA 93555-6001

IN REPLY REFER TO
10570
2662/185
15 Dec 87

MEMORANDUM

From: Head, Environmental Division (Code 266)
To: Range Department, Special Projects Office (Code 6204)

Subj: REQUEST TO CUT WILLOWS IN MOUNTAIN SPRINGS CANYON

Encl: (1) Memorandum, Federal Listing of the Inyo Brown Towhee as a Threatened Species

1. We have reviewed your work request to trim back willows along the Mountain Springs Canyon Road so as to minimize driving hazards to your staffs accessing and exiting their project areas.

2. Enclosure (1) listed the Mountain Springs Canyon Road as an important part of the Critical Habitat for the Inyo Brown Towhee. The willows which need to be trimmed are essential to the well being of this species and thereby are protected by the Endangered Species Act. Therefore, special procedures must now be implemented for trimming the willows.

3. For this year, we will work with the labor shop to determine how much will need to be trimmed. In most cases, this will not exceed 2-3 feet back from the edge of the road. This should alleviate safety concerns for this year.

4. At the same time, we will need to initiate a formal consultation with the U. S. Fish and Wildlife Service for a yearly willow maintenance program for the ensuing years.

5. If you have any questions, please contact Dr. Jerry Boggs at 939-3411, extension 300.

Thomas J. McGill

THOMAS J. MCGILL

Copy to:
2602A-M (3)
266
266-S
2662

Writer: J. Boggs, 2662, 3411 X300
Typist: E. Marquez, 3411 X282, 15 Dec 87

United States Department of the Interior

B. ST

FISH AND WILDLIFE SERVICE
FISH AND WILDLIFE ENHANCEMENT
SOUTHERN CALIFORNIA FIELD STATION
Ventura Office
2140 Eastman Avenue, Suite 100
Ventura, California 93003

November 16, 1990

Jerry R. Boggs
Environmental Resources Branch
Environmental Project Office
Department of the Navy
Naval Weapons Center
China Lake, California 93555-6001

Subject: Maintenance activities within Inyo brown towhee habitat, Naval Weapons Station, China Lake California (10570 Ser 0082/13102) (1-6-9-TA-25)

Dear Mr. Boggs:

This letter is in response to your request, received on October 22, 1990, for the Fish and Wildlife Service's (Service) concurrence that willow trimming activities will not adversely affect the federally listed Inyo brown towhee (Pipilo crissalis eremophilus).

As described in your letter, trimming would be conducted during the fall of 1990 along approximately 100 meters of roadway. In most cases, lengths of approximately 2 to 3 feet would be trimmed from the trees which are adjacent to the road. The areas to be trimmed would be marked and monitored by Environmental Project Office biologists. Trimming would be by Navy Public Works personnel.

The Service concurs with your assessment that the proposed activity, if conducted as described, would not adversely affect the Inyo brown towhee and that formal consultation is not required. If you have any questions regarding these comments, please contact Ray Bransfield of my staff at (805) 644-1766.

Sincerely,

Judy P. Hohman

Steven M. Chambers
Office Supervisor

Mth Spr. Cyn.
Info for
you ~
Ray wants
a copy?

DEPARTMENT OF THE NAVY
NAVAL WEAPONS CENTER
CHINA LAKE, CALIFORNIA 93555-6001

IN REPLY REFER TO
10570
2662/130
8 Sep 87

MEMORANDUM

From: Head, Environmental Division (Code 266)

Subj: FEDERAL LISTING OF THE INYO BROWN TOWHEE AS A THREATENED SPECIES

Encl: (1) Federal Register, Vol. 52, No. 148 of Monday 3 Aug 87, Rules and Regulations, Determination of Threatened Status and Critical Habitat Designation for the Inyo Brown Towhee
(2) Map of Distribution, Inyo Brown Towhee, NAVWPNCEN

1. On 3 August 1987, the U. S. Fish and Wildlife Service announced that they have determined that the Inyo Brown Towhee (Pipilo fuscus eremophilus) qualifies, by their criteria, as a threatened species. Effective immediately, enclosure (1) announces and describes the listing action of this bird.

2. This towhee population (approximately 200 birds) is found in a very limited area of the Argus Range. About 75% of its habitat is on Center lands. Enclosure (2) maps the general distribution of this species on Center lands. Be advised, when viewing this map, that although the range of this sub-species appears to be extensive, these birds are generally confined to areas near riparian or dense vegetation at springs and along water courses. Areas where towhee nesting has been confirmed or is highly probable are designated by U. S. Fish and Wildlife Servise as Critical Habitat. Specific location information is available from our office upon request.

3. If Codes under your jurisdiction have future projects or activities that are near or in the area mapped on enclosure (2), and which might possibly affect this species, please contact the Environmental Resources Management Branch (Code 2662) for guidance.

4. For additional information on this action, please contact Dr. Jerry Boggs, Head, Environmental Resources Management Branch (Code 2662). He can be reached at 3411, extension 300.

Thomas J. McGill

THOMAS J. MCGILL

Subj: FEDERAL LISTING OF THE INYO BROWN TOWHEE AS A THREATENED SPECIES

Distribution:

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Copy to:
2602A-M (3)
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Writer: B. Kohfield, 2662, 3411 X382
Typist: E. Marquez, 3411 X282, 8 Sep 87

United States Department of the Interior

FISH AND WILDLIFE SERVICE

FISH AND WILDLIFE ENHANCEMENT
SOUTHERN CALIFORNIA FIELD STATION
Ventura Office
2140 Eastman Avenue, Suite 100
Ventura, California 93003

July 24, 1990

William T. Eckhardt
Environmental Resources Management Branch
Public Works Department (Code 2662)
Department of the Navy
Naval Weapons Center
China Lake, California 93555-6001

Subject: Biological Opinion for the Removal of Aquatic Vegetation from Mohave Tui Chub Habitat (10570 Ser 2662/7546) (1-6-90-F-40)

Dear Mr. Eckhardt:

This Biological Opinion responds to your request for formal consultation with the Fish and Wildlife Service (Service) pursuant to Section 7 of the Endangered Species Act of 1973, as amended (Act). Your request was dated June 14, 1990 and received by us on June 18, 1990. At issue are the impacts that the removal of aquatic vegetation from drainage channels may have on the Mohave tui chub (Gila bicolor mohavensis), a federally listed endangered species.

This Biological Opinion was prepared using information: contained in your June 14, 1990 request for consultation to the Service's Office Supervisor regarding the proposed project; obtained during informal consultation between our staffs; and contained in the Service's October 20, 1982 Biological Opinion to the Navy regarding the removal of aquatic vegetation from chub habitat (1-1-82-F-127) (Service 1982).

Biological Opinion

It is the opinion of the Service that the proposed project is not likely to jeopardize the continued existence of the Mohave tui chub.

Project Description

The Naval Weapons Center (Center) has proposed to remove cattails (Typha sp.) from portions of the approximately 587 linear feet of channel, an area of 0.16 acre, which connects the feeding pond area with Lark Seep Lagoon (Figure 1). Normally, this work

is done in October or November to avoid the chub's breeding season (March through September) and seasonal temperature extremes (June through August and December through February) (Service 1982). Although cattail removal occurred in the fall of 1989, as required by the Service's 1982 Biological Opinion, the growth of vegetation in the late spring of 1990 was extremely rapid. Center biologists are concerned that the channel containing the chub will become congested with cattails prior to their scheduled removal in the fall. The dense vegetation could interfere with the movement of chubs and have adverse effects on water quality, such as depressing dissolved oxygen levels at night.

The vegetation in the channels would be removed mechanically with a Grade-All earth mover or by a clamshell dredge mounted on a crane. The Grade-All would operate on existing roads that parallel the drainage channels. This machine has a front-mounted scoop capable of extending approximately five meters in any direction. It has a minimum swath width of one meter. The clamshell dredge would be used in areas where the Grade-All does not have road access. The spoil would be deposited on the landward side of the access road or hauled from the site.

A monitor from the Center's Environmental Resources Management Branch will be on-site the entire time to ensure that cattail removal is done in the described manner and to salvage any chubs which are captured by the dredges. Work will proceed in a downstream direction to reduce siltation. Additionally, efforts will be made to scare the fish from the immediate work site prior to vegetation removal. Salvaged fish will be placed in a large bucket containing water from the channel and portable fish aerators. Water temperatures will be monitored as necessary. After the dredging operation has left a specific reach, any captured chubs will be returned by lowering the bucket into the channel.

Effects of the Proposed Project on the Listed Species

Species Account

Information on the biology of the Mohave tui chub is contained in the Service's (1982) previous Biological Opinion to the Navy on cattail removal at the Center. That account noted that the chub population at the Center was estimated at over 10,000 in 1981. A population survey conducted in 1989 estimated that 18,500 chubs inhabit the seep and channel system on the Center. Approximately 10,000 chubs, the greatest concentration of fish in the system, are estimated to reside within the portion of the proposed project area lying north of Water Road (Figure 2). Approximately 6,000 fish inhabit the area south of Water Road, within the area known as the feeding pond (Figure 2).

Analysis of Impacts

The proposed aquatic vegetation removal has the potential to eliminate some chub habitat and to take some individuals which reside in the channel. The proposed action would temporarily reduce the amount of cover available and alter the configuration of the substratum. Turbidity would be increased at times when the dredge is operating. Food sources could be altered for some time after dredging. Some individual chubs could also be injured or killed by the dredge machinery.

The adverse impacts of the dredging would be offset by the long-term benefits derived by removing portions of the aquatic vegetation from the channel. Removing the extremely dense cattail growth will reduce the potential for adverse water quality problems, such as depressed dissolved oxygen concentrations at night, and increase the structural diversity of the channels by creating an open channel with intermittent patches of vegetation. In fact, the recovery plan for the Mohave tui chub recommends that vascular aquatic plants be periodically removed from various refugia, as needed (Service 1984). The take of individual fish will be reduced through the monitoring efforts, described above, of the Center's environmental personnel.

The Service believes the impacts described above will not jeopardize the continued existence of the species. We present this conclusion for the following reasons:

1. The proposed action is intended to result in elimination of potentially lethal water quality problems within the chubs' habitat.

2. Similar actions have occurred in the past (although during more favorable seasons) and have not resulted in the extirpation or obvious long-term depression of the population.

3. The Center has proposed several measures, as part of its project description, to reduce the take of individual fish.

Cumulative Effects

Cumulative effects are those impacts of future State and private actions that are reasonably certain to occur in the project area. Future Federal actions will be subject to the consultation requirements established in Section 7 of the Act and, therefore, are not considered cumulative to the proposed project.
Many of the actions that are reasonably expected to occur within the vicinity of the project will be subject to Section 7 consultations, because the Navy owns large portions of the surrounding lands. Lands to the south of the Center, particularly the City of Ridgecrest, are privately owned. A portion of the water within the seep and channel system emanates from sewage ponds which are fed by the City. The City has been ordered by the Regional Water Quality Control Board to reduce the pond's leakage.

The reduction in leakage may affect the quantity and quality of the water flowing underground to the chubs' habitat. The Service is working with the Navy, the City, and the California Department of Fish and Game to resolve this issue. The outcome will likely result in a Section 7 consultation between the Navy and the City, and is therefore, theoretically, not cumulative to the proposed action. However, the ties between the City and the action, and the source of the water and the chubs' habitat are so intricate that they bear mentioning in any consideration of the future of this subspecies.

Incidental Take

Section 9 of the Act prohibits the take of listed species without special exemption. Taking is defined as harassing, harming, pursuing, hunting, shooting, wounding, killing, trapping, capturing, collecting, or attempting to engage in any such conduct. Harm is further defined to include significant habitat modification or degradation that results in death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering. Under the terms of Section 7(b)(4) and 7(o)(2) of the Act, taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with this Incidental Take statement. The measures described below are nondiscretionary, and must be undertaken by the agency or made a binding condition of any grant or permit, as appropriate.

Based on the information appended to your request for consultation and the analysis of impacts provided above, the Service anticipates that as many as 16,000 Mohave tui chubs could be affected, either directly or indirectly, as a result of the aquatic vegetation removal covered by this Opinion. This Biological Opinion anticipates the following forms of take:

1. Approximately 16,000 chubs (i.e., all of the chubs within the proposed project area) will be subject to harassment in the form of the implemented action, as well as the hazing activities of the Center's environmental personnel, as they attempt to scare fish out of harm's way. This take is not considered to be lethal and, in fact, should reduce the mortality associated with the proposed action.

2. Approximately 1,000 chubs may be subject to further harassment in the event they are caught by the dredge, recovered from the spoil piles, and returned to the channels. Once again, this take is not considered to be lethal and should reduce the mortality associated with the proposed action.

3. Approximately 500 chubs may be killed if they are captured by the dredge and/or not recovered from the spoil pile.

Reasonable and Prudent Measures

The Service believes that the following Reasonable and Prudent Measures are necessary and appropriate to minimize the incidental taking authorized by this Biological Opinion:

1. The proposed action, removal of aquatic vegetation, shall be restricted to the 587 foot long channel between the feeding pond and Lark Seep Lagoon and accomplished in a manner that will maintain habitat values for the Mohave tui chub.

2. The proposed action shall be monitored by Environmental Resources Management Branch personnel during all phases of work which have the potential to take chubs.

Terms and Conditions

To comply with the Reasonable and Prudent Measures contained in this Biological Opinion, the Navy must abide by the Terms and Conditions presented in this Opinion. These Terms and Conditions are as follows:

1A. The removal of aquatic vegetation shall be restricted to the 587 foot long channel between the feeding pond and Lark Seep Lagoon, depicted in Figure 2.

1B. Spoils shall be deposited on landward side of the access road or hauled from the site, as described in the Service's previous Biological Opinion (1-1-82-F-117) for aquatic vegetation removal at the Center.

1C. Scattered patches of aquatic vegetation shall be left in the channel and feeding pond to provide cover for chubs. Vegetation removal shall not exceed that recommended in the Service's previous Biological Opinion (1-1-82-F-117), but may be less, given that the routine yearly maintenance will be implemented in October or November.

2A. At least one biologist from the Environmental Resources Management Branch shall monitor the dredging and all other activities which have the potential to take chubs at all times.

2B. The equipment to be used within the channel shall be limited to a grade-all. The equipment operator shall be fully informed regarding the measures to be implemented to reduce the take of chubs.

2C. The biological monitor shall undertake measures to scare as many chubs as possible away from the area to be dredged, immediately prior to the onset of work in that area.

2D. Dredged materials shall be constantly monitored for chubs. Any chubs found within the spoils shall be placed in a large bucket of water from the channel and supplied with portable aerators. The fish shall be held until the dredging operation has passed through the area of capture. Release shall be as near as possible to the point of capture through the lowering of the bucket into the channel to allow the fish to swim away without being further handled.

2E. Dredging shall occur in a downstream direction to minimize siltation of chub habitat.

2F. Persons authorized to handle Mohave tui chubs as a result of this action shall be limited to biologists from the Naval Weapons Center's Environmental Resources Management Branch.

If, during the course of the action, the Incidental Take authorized by this Opinion is reached, the Navy shall immediately cease the activity resulting in the take and reinitiate formal consultation with the Service.

The Service is to be notified within three working days should any threatened species be found dead or injured during this project. Notification must include the date, time, location of the carcass, and any other pertinent information. Dead animals should be properly preserved and deposited at a facility acceptable to the Service and the California Department of Fish and Game. The Service contact person is Ray Bransfield.

Conservation Recommendations

In furtherance of the purposes of the Endangered Species Act (Sections 2(c) and 7(a)(1)) that mandate Federal agencies to utilize their authorities to carry out programs for the conservation of listed species, we recommend implementing the following action:

1. The Navy should develop and implement, with the assistance of the Service and the California Department of Fish and Game, a management plan for the Mohave tui chub and its habitat on the Center that will ensure their continued long-term viability. This recommendation is made with the realization that continued dredging of the channels will be increasingly difficult as the channels become deeper as a result of dredging activity.

This concludes formal consultation on the removal of aquatic vegetation from Mohave tui chub habitat at the Naval Weapons Center. If the action is significantly modified in a manner not discussed above, if new information becomes available on listed species or impacts to listed species, or if the incidental take limit is met, reinitiation of formal consultation with the Service should be considered. Any questions or

comments should by directed to Ray Bransfield of my staff at FTS 983-6040 or (805) 644-1766.

Sincerely,

Peter Stine
Office Supervisor

Enclosures

Figure 1. Map indicating area that needs immediate cattail removal
Figure 2. Map with 1989 Mohave tui chub population estimate

Literature Cited

Fish and Wildlife Service. 1982. Formal consultation regarding the aquatic vegetation maintenance program proposed for China Lake Naval Weapons Center, San Bernardino County, California (1-1-82-F-117). Portland, OR.

Fish and Wildlife Service. 1984. Recovery plan for the Mohave tui chub (Gila bicolor mohavensis). Sacramento, CA.

0 6 MAY 1997

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

May 2, 1997

Carolyn A. Shepherd
Head, Environmental Project Office
Public Works Department
Naval Air Weapons Station
1 Administration Circle
China Lake, California 93555-6100

Subject: Biological Opinion for Enhancement of Mohave Tui Chub Habitat on the Naval Air Weapons Station, China Lake, Kern County, California (5090 Ser 83EOOOD/0567) (1-8-97-F-15)

Dear Ms. Shepherd:

This biological opinion responds to your request for formal consultation with the U.S. Fish and Wildlife Service (Service) pursuant to section 7 of the Endangered Species Act of 1973, as amended (Act). Your request was dated January 28, 1997 and received in our office on January 31, 1997. At issue are the effects that the Naval Air Weapons Station's (NAWS) proposed habitat enhancement activities near Lark Seep Lagoon may have on the Mohave tui chub (*Gila bicolor mohavensis*), federally listed as an endangered species.

This biological opinion was prepared using information from the following sources: your January 28, 1997, request for consultation regarding the proposed action; discussions between Navy and Service staff; and our files.

Biological Opinion

It is the opinion of the Service that the proposed action is not likely to jeopardize the continued existence of the Mohave tui chub. Critical habitat has not been designated for the Mohave tui chub.

Description of the Proposed Action

To maintain the water distribution capacity of a system of channels connecting the Lark and G-1 Seeps, the NAWS routinely excavates cattails (*Typha latifolia*) from the channel system.

Clearing is necessary because the channels in the Lark Seep/G-1 Spring system are not sufficiently deep to prevent cattails from spreading and clogging the channels. The channel clearing also benefits the Mohave tui chub because they prefer open water conditions. The proposed action, to deepen and widen approximately 250 feet of channel south of Lark Seep, is intended as an experiment to determine if NAWS can modify the channels to minimize maintenance needs and provide for improved habitat conditions for Mohave tui chub.

To accomplish the proposed action, the channel would be dredged, with widening to be accomplished by removing sediment on the east bank of the channel to preserve the existing saltgrass (*Distichlis* sp.) on the western bank. The width and depth of the channel would depend upon the capability of the heavy equipment employed but the NAWS anticipates that the channel would be 15 to 20 feet wide and 6 to 8 feet deep at the channel centerline. The east wall of the channel would be slope steeply while the west wall would slope gently to provide suitable habitat for cattails. The NAWS anticipates that the proposed modifications would increase flows to Lark Seep and minimize the need for recurring channel maintenance.

To improve flows to the channel system immediately downstream of the Bologna Pool and Water Road, a stand of tamarisk (*Tamarix* sp.) would be removed and a culvert placed to ensure flows continue through the area. To improve access to the culvert area and for maintenance purposes, the access road would be extended approximately 50 feet to the south to intersect Water Road.

The NAWS proposes to implement the following measures to minimize the effect of the action on the Mohave tui chub:

1. A seine would be used to move Mohave tui chub upstream toward the Bologna Pool. The seine would then be anchored to keep Mohave tui chub away from the construction zone.

2. Dredging would be accomplished in an upstream to downstream direction to ensure that disturbance of an area occurs only once.

3. Equipment operators would be briefed on the restrictions involved in working in the project area.

4. Removal of soil and vegetation would be accomplished carefully and slowly to minimize water turbidity.

5. The rate of water flow and water quality parameters (total dissolved solids, dissolved oxygen, pH, and temperature) will be monitored starting before dredging begins. Monitoring of the Mohave tui chub population will be accomplished with a mark/recapture program that would start before the project begins and continue on an annual basis, as funding permits, following completion of the enhancement work.

Effects of the Proposed Action on the Listed Species

Species Account

The Mohave tui chub occurred historically in the Mojave River from the confluence of the east and west forks at the base of the San Bernardino Mountains to its terminus at Soda Dry Lake. It is the only native fish in this river system. The Mojave tui chub currently does not exist in natural habitats within its native range with the possible exception of one small spring adjacent to Soda Dry Lake. Habitat modifications, including damming of the headwaters and withdrawals of the river's underflow, and hybridization with an introduced species, the arroyo chub (*Gila orcutti*), contributed to the decline of the species. The Mohave tui chub was listed as endangered by the Service in 1970 (35 FR 16047) and by the State of California in 1971. The recovery plan for the Mohave tui chub, issued by the Service in 1983, contains additional information on the life history and physiological requirements of the species.

Current information indicates that genetically pure populations of Mohave tui chub now exist only in the Lark and G-1 Seep system on the Naval Air Weapons Station at China Lake, MC Spring and Soda Springs, along the western shore of Soda Lake, and at Camp Cady, along the Mojave River channel west of Afton Canyon. All of these refugia require relatively intensive management that may include periodic excavation to maintain open water conditions.

Status of the Species in the Project Area

The Lark and G-1 Seep system on the NAWS occurs because the groundwater table in the area is elevated by seepage from the City of Ridgecrest's wastewater treatment ponds. In the 1960s the NAWS excavated the current system of channels to prevent damage to facilities from rising groundwater (Feldmeth 1984). The Mohave tui chub was introduced into the channel system in 1971 as part of a transplantation effort by the California Department of Fish and Game. As water levels rose through the years, the Mohave tui chub population increased and expanded in range. Recent estimates by the NAWS place the population of Mohave tui chub at approximately 10,000 individuals.

The channels carrying water from Lark Seep to G-1 Seep contain relatively more Mohave tui chub than the lagoon areas. The flowing water in these channels probably mitigates temperature and water quality problems which could occur during the summer months at the NAWS and may simulate the Mohave tui chub's natural habitat in the Mojave River. The lagoons and channels support extensive stands of cattails which periodically must be cleared to ensure water flow through the channel system and to maintain habitat for the Mohave tui chub. Clearing the channels of cattails is addressed in an existing biological opinion (1-6-90-F-40).

Analysis of Effects

Individual Mohave tui chubs within the project area may be injured or killed as a result of activities associated with seining the existing channel, dredging, and placement of the new culvert near Water Road. Increased turbidity in the channel could temporarily reduce the fitness of individual Mohave tui chubs and result in increased predation and susceptibility to disease or other environmental stresses. An unknown number of Mohave tui chub would be harassed as a result of this project.

Measures proposed by the NAWS would minimize the likelihood for injury or death of Mohave tui chubs during implementation of this action. In addition, the enhancement work would result in a number of benefits to the species including an increase in available habitat for the Mohave tui chub and habitat that would require less intensive management. Management of habitat is an increasingly significant issue as funds earmarked for channel maintenance decline. Thus, the proposed modifications to the channel system are desirable because they minimize the need for management activities and stabilize habitat conditions.

Due to the nature of the channels and the methods used to clear vegetation, ascertaining precisely how many Mohave tui chub are killed or injured by clearing activities will be difficult. However, in a report to the Service by the NAWS on a past clearing action, the on-site monitors observed only three dead or injured Mohave tui chub (NAWS 1990).

The Service believes that the effects described above are not likely to jeopardize the continued existence of the Mohave tui chub. We base this conclusion on the following facts:

1. The measures proposed by the NAWS should greatly minimize the likelihood for adverse effects to individual Mohave tui chubs.

2. Projects similar in overall disturbance to the proposed action have been accomplished with little adverse effect on the Mohave tui chub.

3. This action would help to insure the survival of the Mohave tui chub population on the NAWS and enhance available habitat for the species.

Cumulative Effects

Cumulative effects are those impacts of future State and private actions that are reasonably certain to occur in the project area. Future Federal actions will be subject to the consultation requirements established in section 7 of the Act and, therefore, are not considered cumulative to the proposed project. Many of the actions that are reasonably expected to occur within the vicinity of this action will be subject to formal consultation, as mandated by section 7 of the Act, because the NAWS manages surrounding lands.

Incidental Take

Section 9 of the Endangered Species Act prohibits any taking (i.e., to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct) of listed species without special exemption. Harm is further defined to include significant habitat modification or degradation that results in the death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering. Under the terms of sections 7(b)(4) and 7(o)(2) of the Act, taking that is incidental to and not a purpose of the agency action is not considered taking within the bounds of the Act, provided that such taking is in compliance with this incidental take statement. The measures described below as reasonable and prudent measures and terms and conditions are nondiscretionary, and must be undertaken by the agency or made a binding condition of any grant or permit, as appropriate.

This biological opinion anticipates the following forms of take:

1. Fifty (50) Mohave tui chubs in the form of direct mortality or injury resulting from dredging activities, increased turbidity, or stress. The Service and Navy cannot precisely anticipate the number of Mohave tui chubs that may be present in the channel during this action. Therefore, the Service is unable to estimate accurately the number of Mohave tui chubs that may be killed or injured during this action. However, the incidental take level of 50 Mohave tui chubs in the form of mortality or injury will enable the NAWS to determine whether its actions are resulting in adverse effects beyond those which it and the Service have anticipated and allow the NAWS to modify its action, if necessary, to prevent or reduce additional mortality.

2. An unknown number of Mohave tui chubs in the project area in the form of harassment through vibration, increased turbidity, and fluctuations in water level. The Service and Navy cannot precisely anticipate the number of Mohave tui chubs that may be present in the channel during this action. Therefore, the Service is unable to estimate accurately the number of Mohave tui chubs that may be harassed during this action.

This biological opinion does not authorize any form of take that is not incidental to the proposed project. If the incidental take authorized by this biological opinion is met, the NAWS shall immediately notify the Service in writing. If the incidental take authorized by this opinion is exceeded, the NAWS shall immediately cease the activity resulting in the take and shall reinitiate formal consultation with the Service.

Reasonable and Prudent Measures

The Service believes that the following reasonable and prudent measures are necessary and appropriate to minimize the incidental taking authorized by this biological opinion.

6. Care shall be exercised to ensure that, when fueling or maintaining equipment, that hazardous materials do not contact the channels. When feasible, refueling of vehicles shall occur at least 50 feet from channels. Spill containment measures, such as placement of plastic sheeting under vehicles, shall be used whenever refueling occurs in or near Mohave tui chub habitat. All project-related spills of hazardous materials within or adjacent to the construction zone shall be cleaned up immediately.

Reporting Requirements

Following project completion, the NAWS shall prepare a report for the Service. The report shall document the effectiveness of the terms and conditions, the number of Mohave tui chubs killed or injured, and the circumstances that led to injury or death of Mohave tui chub. The report shall make recommendations for modifying the terms and conditions to enhance Mohave tui chub protection for future actions.

Disposition of Dead or Injured Mohave Tui Chubs

Upon locating dead or injured Mohave tui chubs, initial notification must be made in writing to the Service's Division of Law Enforcement in Torrance, California (370 Amapola Avenue, Suite 114, Torrance, California 90501) and by telephone and writing to the Ventura Fish and Wildlife Office in Ventura, California, (2493 Portola Road, Suite B, Ventura, California 93003, (805) 644-1766) within three working days of finding the animal. The report shall include the date and time the animal was found, the location where the animal was found, a photograph of the animal, cause of death, if known, and any other pertinent information.

Care shall be taken in handling dead specimens to preserve biological material in the best possible state for later analysis. The remains of intact Mohave tui chubs shall be placed with educational or research institutions holding the appropriate State and Federal permits
If the carcass is in a condition such that it would no longer be useful to educational or research institutions, the information noted above shall be obtained and the carcass properly discarded.

Arrangements regarding proper disposition of potential museum specimens shall be made with the institution by the NAWS through a biologist prior to implementation of the action.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service offers the following conservation recommendation:

Should the channel deepening and widening efforts prove effective for enhancing Mohave tui chub habitat and minimizing channel maintenance needs, we recommend that NAWS undertake similar efforts for the remainder of the Lark and G-1 Seep system.

The Service requests notification of the implementation of this conservation recommendation to keep us informed of actions that either minimize or avoid adverse effects or that benefit listed species or their habitats.

Conclusion

This concludes formal consultation on the NAWS's proposal to enhance habitat for Mohave tui chub near Lark Seep, Kern County, California. Reinitiation of formal consultation is required if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may adversely affect listed species or critical habitat in a manner not considered in this opinion; 3) the agency action is subsequently modified in a manner that causes an effect to a listed species or critical habitat that was not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by this action (50 CFR 402.16). Any expansion of activities beyond the scope proposed would be considered reason to reinitiate consultation. Any comments or questions should be directed to Kirk Waln of my staff at (805) 644-1766.

Sincerely,

for Diane K. Noda
Field Supervisor

Literature Cited

Feldmeth, C.R. 1984. A natural resource survey of the Lark seep system with special emphasis on the endangered Mohave chub. Ecological Research Services, Claremont, California.

Naval Air Weapons Station, China Lake. 1990. Letter to the Service regarding incidental take of Mohave tui chub during with channel clearing near Lark Seep.

U.S. Fish and Wildlife Service. 1983. Recovery plan for the Mohave tui chub, *Gila bicolor mohavensis*. Portland, Oregon.

CS
TC
Susan

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ventura Fish and Wildlife Office
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Ventura, California 93003

12 AUG 1997

August 7, 1997

Carolyn A. Shepherd
Head, Environmental Project Office
Public Works Department
Naval Air Weapons Station
1 Administration Circle
China Lake, California 93555-6100

Subject: Reinitiation of Formal Consultation on the Removal of Aquatic Vegetation from Mohave Tui Chub Habitat on the Naval Air Weapons Station, China Lake, Kern County, California (5090 Ser 83EOOOD/1379) (1-8-97-F-39R)

Dear Ms. Shepherd:

This biological opinion responds to your request for formal consultation with the U.S. Fish and Wildlife Service (Service) pursuant to section 7 of the Endangered Species Act of 1973, as amended (Act). Your request was dated December 17, 1996 and received in our office on January 9, 1997. At issue are the effects that the Naval Air Weapons Station's (NAWS) proposed channel clearing activities in the Lark and G1 Seep system may have on the Mohave tui chub (*Gila bicolor mohavensis*), which is federally listed as an endangered species.

This biological opinion was prepared using information from the following sources: your December 17, 1996, request for consultation regarding the proposed action; discussions between Navy and Service staff; and our files.

Biological Opinion

It is the opinion of the Service that the proposed action is not likely to jeopardize the continued existence of the Mohave tui chub. Critical habitat has not been designated for the Mohave tui chub.

Description of the Proposed Action

To maintain the water distribution capacity of a system of channels connecting Lark and G1 Seeps, the NAWS routinely excavates cattails (*Typha latifolia*) from the channel system.

Clearing is necessary because the channels in the Lark/G1 Seep system are not sufficiently deep to prevent cattails from spreading and clogging the channels. The channel clearing also benefits the Mohave tui chub because they prefer open water conditions. The proposed action, to selectively remove cattails from approximately two miles of channels, represents a significant expansion over the approximately 600 linear feet of channel cleared under the auspices of the previous biological opinion for channel clearing issued on July 24, 1990 (1-6-90-F-40).

The NAWS proposes to accomplish the proposed channel clearing by expanding the scope of past clearing activities. Further detail regarding the clearing techniques and equipment to be used is contained in the "Project Description" section of the (1-6-90-F-40) biological opinion (enclosed).

To minimize the effects of the action on the Mohave tui chub, the NAWS proposes the following:

1. To implement, with one modification, the terms and conditions from the previous biological opinion issued for channel clearing (1-6-90-F-40). The NAWS proposes to modify term and condition 1C of the 1-6-90-F-40 biological opinion to permit removal of aquatic vegetation between October 1 and January 31.

2. To better monitor population levels, distribution, and the effects of channel clearing, the NAWS proposes to implement a mark and recapture program.

a. NAWS Environmental Project staff, or personnel under their direct supervision, would mark and recapture Mohave tui chubs over the course of two days in late spring while temperatures are moderate and dissolved oxygen levels are high.

b. Modified minnow traps would be set and checked in the morning, afternoon, and evening. Captured fish would be placed in a bucket filled with channel water from the trap site.

c. Tricaine methanesulfonate (Finquel), a mild anesthetic, would be applied to captured fish in the bucket to facilitate weighing and measuring the fish. Fish would be marked by clipping a section of the left pectoral fin. Following processing, fish would be transferred to a second bucket of untreated channel water for recovery from the anesthetic. The fish would be monitored closely and not returned to the channel until they are fully recovered.

3. The rate of water flow and water quality parameters (total dissolved solids, dissolved oxygen, pH, and temperature) would be monitored at an undetermined number of sites in channels and seeps. Associated with the water quality monitoring, the NAWS proposes a one time release, into an appropriate point in the seep system, of an approved, non-toxic dye to aid in determining the pattern of connection, if any, between channels and seeps.

Effects of the Proposed Action on the Listed Species

Species Account

The Mohave tui chub occurred historically in the Mojave River from the confluence of the east and west forks at the base of the San Bernardino Mountains to its terminus at Soda Dry Lake. It is the only native fish in this river system. The Mohave tui chub currently does not exist in natural habitats within its native range with the possible exception of one small spring adjacent to Soda Dry Lake. Habitat modifications, including damming of the headwaters and withdrawals of the river's underflow, and hybridization with an introduced species, the arroyo chub (*Gila orcutti*), contributed to the decline of the species. The Mohave tui chub was listed as endangered by the Service in 1970 (35 FR 16047) and by the State of California in 1971. The recovery plan for the Mohave tui chub (Service 1983), contains additional information on the life history and physiological requirements of the species.

Current information indicates that genetically pure populations of Mohave tui chub now exist only in the Lark and G1 Seep system on the Naval Air Weapons Station at China Lake, MC Spring and Lake Tuendae, along the western shore of Soda Lake, and at Camp Cady along the Mojave River channel west of Afton Canyon. All of these refugia require relatively intensive management that may include periodic excavation to maintain open water conditions.

Status of the Species in the Project Area

The Lark and G1 Seep system on the NAWS occurs because the groundwater table in the area is elevated by seepage from the City of Ridgecrest's wastewater treatment ponds. In the 1960s the NAWS excavated the current system of channels to prevent damage to facilities from rising groundwater (Feldmeth 1984). The Mohave tui chub was introduced into the channel system in 1971 as part of a transplantation effort by the California Department of Fish and Game. As water levels rose through the years, the Mohave tui chub population increased and expanded in range. Recent estimates by the NAWS place the population of Mohave tui chub at approximately 10,000 individuals.

The channels carrying water from Lark Seep to G1 Seep contain relatively more Mohave tui chub than the lagoon areas. The flowing water in these channels probably mitigates temperature and water quality problems which could occur during the summer months at the NAWS and may simulate the Mohave tui chub's natural habitat in the Mojave River. The lagoons and channels support extensive stands of cattails which periodically must be cleared to ensure water flow through the channel system and to maintain habitat for the Mohave tui chub.

Analysis of Effects

Individual Mohave tui chubs within the project area may be injured or killed as a result of activities associated with dredging and population monitoring. Increased turbidity in the channel

could temporarily reduce the fitness of individual Mohave tui chubs and result in increased predation and susceptibility to disease or other environmental stresses. An unknown number of Mohave tui chubs would be harassed as a result of this project.

Measures proposed by the NAWS would minimize the likelihood for injury or death of Mohave tui chubs during implementation of this action. In combination with modifications to the channel below the "bologna pool" addressed in an earlier biological opinion (1-8-97-F-15), the proposed channel maintenance activities are desirable because they likely would result in benefits to the species through improved habitat conditions and an overall increase in available habitat.

Due to the nature of the channels and the methods used to clear vegetation, ascertaining precisely how many Mohave tui chubs are killed or injured by clearing activities will be difficult. However, in a report to the Service by the NAWS on a past clearing action, the on-site monitors observed only three dead or injured Mohave tui chubs (NAWS 1990).

The Service believes that the effects described above are not likely to jeopardize the continued existence of the Mohave tui chub. We base this conclusion on the following facts:

1. The measures proposed by the NAWS should greatly minimize the likelihood for adverse effects to individual Mohave tui chubs.

2. Similar channel clearing activities by the NAWS have been accomplished with little adverse effect on the Mohave tui chub.

3. This action would help to insure the survival of the Mohave tui chub population on the NAWS and enhance available habitat for the species.

Cumulative Effects

Cumulative effects are those impacts of future State and private actions that are reasonably certain to occur in the project area. Future Federal actions will be subject to the consultation requirements established in section 7 of the Act and, therefore, are not considered cumulative to the proposed project. Many of the actions that are reasonably expected to occur within the vicinity of this action will be subject to formal consultation, as mandated by section 7 of the Act, because the NAWS manages surrounding lands.

Incidental Take

Section 9 of the Endangered Species Act prohibits any taking (i.e., to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct) of listed species without special exemption. Harm is further defined to include significant habitat modification or degradation that results in the death or injury to listed species by significantly impairing essential behavior patterns, including breeding, feeding, or sheltering. Under the terms

of sections 7(b)(4) and 7(o)(2) of the Act, taking that is incidental to and not a purpose of the agency action is not considered taking within the bounds of the Act, provided that such taking is in compliance with this incidental take statement. The measures described below as reasonable and prudent measures and terms and conditions are nondiscretionary, and must be undertaken by the agency or made a binding condition of any grant or permit, as appropriate.

This biological opinion anticipates the following forms of take:

1. One hundred fifty (150) Mohave tui chubs in the form of direct mortality or injury resulting from dredging activities during each year dredging operations are necessary. The Service and Navy cannot precisely anticipate the number of Mohave tui chubs that may be present in the channels during dredging activities. Therefore, the Service is unable to estimate accurately the number of Mohave tui chubs that may be killed or injured during this action. However, the incidental take level of 150 Mohave tui chubs in the form of mortality or injury will enable the NAWS to determine whether its actions are resulting in adverse effects beyond those which it and the Service have anticipated and allow the NAWS to modify its action, if necessary, to prevent or reduce additional mortality.

2. An unknown number of Mohave tui chubs in the project area in the form of harassment through vibration, increased turbidity, and fluctuations in water level during dredging activities. The Service and Navy cannot precisely anticipate the number of Mohave tui chubs that may be present in the channel during this action. Therefore, the Service is unable to estimate accurately the number of Mohave tui chubs that may be harassed during this action.

3. Five (5) Mohave tui chubs per year in the form of direct mortality or injury through capture and processing of individuals of the species during population monitoring activities.

This biological opinion does not authorize any form of take that is not incidental to the proposed project. If the incidental take authorized by this biological opinion is met, the NAWS shall immediately notify the Service in writing. If the incidental take authorized by this opinion is exceeded, the NAWS shall immediately cease the activity resulting in the take and shall reinitiate formal consultation with the Service.

Reasonable and Prudent Measures

The Service believes that the following reasonable and prudent measures are necessary and appropriate to minimize the incidental taking authorized by this biological opinion.

1. Take of Mohave tui chubs, through injury or death, within proposed project areas shall be reduced through establishment of well-defined operational procedures.

2. Take of Mohave tui chubs, through injury or death, within proposed project areas shall be reduced through establishment of clearly defined work areas.

Terms and Conditions

To be exempt from the prohibitions of section 9 of the Act, the NAWS is responsible for compliance with the following term and condition, which implements the reasonable and prudent measures described above.

1. The following term and condition implements reasonable and prudent measures 1 and 2:

   NAWS shall fully implement the terms and conditions of the 1-6-90-F-40 biological opinion, incorporated herein by reference. Term and condition 1C in the 1-6-90-F-40 biological opinion is modified to allow for dredging operations to occur between October 1 and January 31. NAWS shall fully implement the mitigation measures contained in the NAWS letter requesting consultation and repeated in the "Description of the Proposed Action" portion of this biological opinion.

Reporting Requirements

The NAWS shall prepare a yearly report for the Service documenting the locations and results of any dredging and population monitoring activities. The report shall document the effectiveness of the terms and conditions, the number of Mohave tui chubs killed or injured, and the circumstances that led to injury or death of Mohave tui chubs. The report shall make recommendations for modifying the terms and conditions to enhance the protection of Mohave tui chubs for future actions.

Disposition of Dead or Injured Mohave Tui Chubs

Upon locating dead or injured Mohave tui chubs, initial notification must be made in writing to the Service's Division of Law Enforcement in Torrance, California (370 Amapola Avenue, Suite 114, Torrance, California 90501) and by telephone and writing to the Ventura Fish and Wildlife Office in Ventura, California, (2493 Portola Road, Suite B, Ventura, California 93003, (805) 644-1766) within three working days of finding the animal. The report shall include the date and time the animal was found, the location where the animal was found, a photograph of the animal, cause of death, if known, and any other pertinent information.

Care shall be taken in handling dead specimens to preserve biological material in the best possible state for later analysis. The remains of intact Mohave tui chubs shall be placed with educational or research institutions holding the appropriate State and Federal permits
If the carcass is in a condition such that it would no longer be useful to educational or research institutions, the information noted above shall be obtained and the carcass properly discarded.

Arrangements regarding proper disposition of potential museum specimens shall be made with the institution by the NAWS through a biologist prior to implementation of the action.

Conservation Recommendations

Section 7(a)(1) of the Act directs Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The Service offers the following conservation recommendation:

> Should the experimental channel deepening and widening efforts undertaken below the "bologna pool" prove effective for enhancing Mohave tui chub habitat and minimizing channel maintenance needs, we recommend that NAWS undertake similar efforts for the remainder of the Lark and G1 Seep system.

The Service requests notification of the implementation of this conservation recommendation to keep us informed of actions that either minimize or avoid adverse effects or that benefit listed species or their habitats.

Conclusion

This concludes formal consultation on the NAWS's proposal to expand the channel maintenance activities in the Lark and G1 Seep system, Kern County, California. Reinitiation of formal consultation is required if: 1) the amount or extent of incidental take is exceeded; 2) new information reveals effects of the agency action that may adversely affect listed species or critical habitat in a manner not considered in this opinion; 3) the agency action is subsequently modified in a manner that causes an effect to a listed species or critical habitat that was not considered in this opinion; or 4) a new species is listed or critical habitat designated that may be affected by this action (50 CFR 402.16). Any expansion of activities beyond the scope proposed would be considered reason to reinitiate consultation. Any comments or questions should be directed to Kirk Waln of my staff at (805) 644-1766.

Sincerely,

Judy Holman

Diane K. Noda
Acting Field Supervisor

Enclosure

Literature Cited

Feldmeth, C.R. 1984. A natural resource survey of the Lark Seep system with special emphasis on the endangered Mohave chub. Ecological Research Services, Claremont, California.

Naval Air Weapons Station, China Lake, California. 1990. Letter to the U.S. Fish and Wildlife Service regarding incidental take of Mohave tui chubs during with channel clearing near Lark Seep.

U.S. Fish and Wildlife Service. 1983. Recovery plan for the Mohave tui chub, *Gila bicolor mohavensis*. Portland, Oregon.

CS
Steve P

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Ventura Fish and Wildlife Office
2493 Portola Road, Suite B
Ventura, California 93003

In Reply Refer To: 2002-469

16 JUL 2002

July 3, 2002

Carolyn A. Shepherd
Head, Environmental Project Office
Naval Air Weapons Station
1 Administration Circle
China Lake, California 93555-6100

Subject: Amendment to Biological Opinion 1-8-97-F-39R , Naval Air Weapons Station, China Lake, Kern County, California

Dear Ms. Shepherd:

This letter constitutes an amendment to the August 7, 1997, biological opinion (1-8-97-F-39R) on the maintenance of habitat for the federally endangered Mohave tui chub (*Gila bicolor mohavensis*). The U.S. Fish and Wildlife Service (Service) has received your letter of June 6, 2001, regarding modifications of the mark-recapture program to better monitor population levels, distribution, and the effects of channel clearing. Specifically, the Naval Air Weapons Station proposes to substitute the Visible Implant Fluorescent Elastomer (VIE) method for tagging individual fish rather than using fin clips, and to change the current mark-recapture schedule from late Spring to early Fall. Supporting information submitted with your request included product information on the VIE methodology, and Haines' and Modde's (1996) paper wherein they evaluated various techniques for marking fish in mark-recapture studies.

The current methodology in the biological opinion for marking the Mohave tui chub uses clips from the left pectoral fin. The VIE tagging method implants or injects a fluorescent elastomer material as a liquid beneath transparent or translucent tissue that soon cures into a pliable, bio-compatible solid. With the cooperation of the California Department of Fish and Game, the Naval Air Weapons Station evaluated the VIE method on a non-listed species of chub to determine its ease of use and to document impacts to the health of the fish. The fluorescent elastomer material was easily applied under the skin, with no apparent harm to the fish. However, Haines and Modde (1996) observed a <1% mortality of age-0 Colorado squawfish (*Ptychocheilus lucius*) due to the VIE injection system, while having no mortality from fin clipping.

The Naval Air Weapons Station has requested to modify the schedule for conducting the annual mark-recapture studies from late Spring to early Fall to avoid the reproductive season of the

Mohave tui chub. An early Fall schedule would still occur during a period of moderate water temperatures and high dissolved oxygen levels.

Our review of the proposed amendment indicates that the change in mark-recapture methodology for marking fish, as well as the change in the schedule, would not significantly change the scope or intent, or alter the net effect or increase the level of take on the Mohave tui chub from that analyzed under the Service's biological opinion 1-8-97-F-39R. Accordingly, the following minimization measure is substituted for minimization measure 2 found in the "Description of the Proposed Action" section of biological opinion 1-8-97-F-39R. The changes from the original measure are underlined.

2. To better monitor population levels, distribution, and the effects of channel clearing, the Naval Air Weapons Station (NAWS) proposes to implement a mark and recapture program.

   a. NAWS Environmental Project staff, or personnel under their direct supervision, would mark and recapture Mohave tui chubs over the course of two days in <u>early Fall</u> while temperatures are moderate and dissolved oxygen levels are high.

   b. Modified minnow traps would be set and checked in the morning, afternoon, and evening. Captured fish would be placed in a bucket filled with channel water from the trap site.

   c. Tricaine methanesulfonate (Finquel), a mild anesthetic, would be applied to captured fish in the bucket to facilitate weighing and measuring the fish. Fish would be marked by using <u>the Visible Implant Fluorescent Elastomer (VIE) method</u>. Following processing, fish would be transferred to a second bucket of untreated channel water for recovery from the anesthetic. The fish would be monitored closely and not returned to the channel until they are fully recovered.

Please call George Walker of my staff at (760) 255-8852 if you have any questions.

Sincerely,

Diane K. Noda
Field Supervisor

REFERENCES CITED

Haines, G.B. and T. Modde. 1996. Evaluation of marking techniques to estimate population size and first-year survival of Colorado squawfish. North American Journal of Fisheries Management 16:905-912.

DEPARTMENT OF TRANSPORTATION
District 9
500 South Main Street
Bishop, CA 93514
PHONE (760-872-0690
FAX (760) 872-0678
TTY (760) 872-9043

Flex your power!
Be energy efficient!

Carolyn A. Shepherd
Head, Environmental Project Office
Naval Air Weapons Station
1 Administration Circle
China Lake, California 93555-6100

Dear Ms. Shepherd:

The enclosed letter from the Fish and Wildlife Service found its way to my office by mistake. I am forwarding the correspondence to you. I have contacted George Walker to let him know that there was a mistake and that the correspondence is forwarded.

I hope that the delay has not caused you any difficulties.

Sincerely,

THOMAS B. DAYAK
Chief, Eastern Sierra Environmental Branch

United States Department of the Interior

FISH AND WILDLIFE SERVICE

2493 Portola Road, Suite B
Ventura, California 93003

August 8, 2003

Carolyn A. Shepherd
Head, Environmental Planning and Management Department
Naval Air Weapons Station
1 Administration Circle
China Lake, California 93555-6100

In Reply, Refer To: PAS 592.637.801

Subject: Amendment to Biological Opinion 1-8-97-F-39R, Naval Air Weapons Station, China Lake, Kern County, California

Dear Ms. Shepherd:

This letter constitutes an amendment to the August 7, 1997, biological opinion (1-8-97-F-39R) on the maintenance of habitat for the federally endangered Mohave tui chub (*Gila bicolor mohavensis*). The U.S. Fish and Wildlife Service (Service) has received your letter of May 30, 2003, which requests our approval of a change in the period when vegetation can be removed from habitat that is occupied by the Mohave tui chub. On July 23, 2003, we received an electronic mail from Mr. Steve Pennix of your staff. His electronic mail asked that the proposed action in the subject biological opinion be amended to include a second, less invasive, method for controlling aquatic vegetation. Vegetation removal from water-filled channels on the Naval Air Weapons Station (NAWS) currently takes place according to terms and conditions contained within the biological opinion entitled *Reinitiation of Formal Consultation on the Removal of Aquatic Vegetation from Mohave Tui Chub Habitat on the Naval Air Weapons Station, China Lake, Kern County, California (1-8-97-F-39R)*.

Your December 17, 1996, request for consultation stated that removal of vegetation should be accomplished between October 1 and January 31 while water temperatures are cooler and Mohave tui chub are not reproducing. The removal of aquatic vegetation from overgrown channels on the NAWS involves the use of an earthmover or clamshell dredge mounted on a crane.

In your May 30 letter, NAWS staff requested we concur with your determination that modifying the period when vegetation removal activities occur on the NAWS is not likely to adversely affect this taxon, *i.e.*, that vegetation removal could begin on or after September 15 of each year instead of the October 1 date that is specified in the proposed action of the subject biological opinion. Your letter summarizes water temperature and dissolved oxygen data that were collected in the North Channel of the Lark Seep System during the last two weeks of September

and the first two weeks of October 2002. These data indicate there is no significant difference ($p<0.05$) in these environmental variables between these two sampling periods. You have therefore concluded that modifying the date of the initiation of cattail removal activities is not likely to create more severe environmental conditions for the Mohave tui chub because water temperatures and dissolved oxygen levels between September 15 and October 1 are essentially the same.

Mr. Pennix's electronic mail provided additional information on the ecology of Mohave tui chub that are present on the NAWS. Mr. Pennix notes that no rigorous studies have been conducted that would establish the actual spawning period for tui chub occurring on the NAWS. He summarized anecdotal observations on the spawning behavior of tui chub (*Gila bicolor* spp.) in the Mojave Desert which suggest that other chub taxa in the region are known to be extremely fecund and have a spawning season beginning in early spring. Previous trapping of Mohave tui chub on the NAWS in May or June occasionally resulted in the capture of fish containing eggs, while trapping in the early part of October 2002, did not result in the capture of any fish that expelled eggs when they were handled. Mr. Pennix also noted one publication indicating that Mojave tui chub have been recorded as spawning primarily from February through May. Therefore, your staff expects that vegetation removal activities during the last two weeks of September would have little or no affect on Mohave tui chub recruitment.

The July 23 electronic mail from Mr. Pennix included a proposal to control the growth of cattails (*Typha* sp.) using a Jensen Lake Mower. The use of the Jensen Lake Mower would be limited to the North Road channel, and involve an area 300-feet long by approximately 15-feet wide. The mower would be attached to the bow of a small boat. The boat will be slowly towed along the channel by two people walking atop opposites sides of the channel. No gas or electric motors will be used to power the boat. An operator in the boat would control the 4-foot wide serrated crosscutting horizontal blades on the mower in a manner that cuts cattails at a depth of two feet below the water surface. A 50-foot swath of cattails will be clipped at a time. Use of the boat and cutter will be limited to channels on the NAWS, and transfer and off-site re-use of the equipment is not planned. The clipped floating cattails will be collected in the channel with a grass rake, pulled into the boat, trucked offsite, and disposed of in an upland area. If difficulties develop as the excess vegetation is removed, further clipping of cattails will cease and NAWS staff will contact the Service to determine if the use of the Jensen Lake Mower should proceed.

The removal of cattails from a 300-foot length of channel using the Jensen Lake Mower will facilitate an evaluation as to whether the mower is a viable tool for removing and eliminating cattails from a larger area of Mohave tui chub habitat on the NAWS. Your staff does not believe that the use of the Jensen Lake Mower will create additional adverse effects beyond those already caused by the annual use of the earthmover or clamshell dredge which is authorized under the subject biological opinion. They also believe the use

of the mower will reduce the adverse effects that are currently allowed under the subject biological opinion, *e.g.*, increases in water

turbidity in the fish's habitat will be greatly reduced and impacts to the bottom substrate will be eliminated.

After reviewing the information contained within your May 30 letter and Mr. Pennix's July 23 electronic mail, we agree that a change in the start date of vegetation control activities on the NAWS from October 1 to September 15 will not change the scope or intent, or alter the net effect or increase the level of take on the Mohave tui chub from that analyzed under the Service's biological opinion 1-8-97-F-39R. Accordingly, the following minimization measure is substituted for minimization measure 1 found in the "Description of the Proposed Action" section of biological opinion 1-8-97-F-39R:

1. To implement, with one modification, the terms and conditions from the previous biological opinion issued for channel clearing (1-6-90-F-40). The NAWS proposes to modify term and condition 1C of the 1-6-90-F-40 biological opinion to permit removal of aquatic vegetation between September 15 and January 31.

The change from the original measure in the biological opinion is underlined, *i.e.*, the date has been changed from October 1 to September 15.

The proposed action in the subject biological opinion is hereby amended to include the use of the Jensen Lake Mower along a 300-foot long portion of the North Road channel. The use of this device to clear cattails will conform to the methods described above. We concur with your determination that the use of the Jensen Lake Mower is not likely to alter the net effect to the species or increase the level of take of fish from that analyzed under the Service's biological opinion 1-8-97-F-39R.

If you have questions of concerns regarding this letter, please call Douglas Threloff of my staff at (760) 644-1766

Sincerely,

Catrina Martin
Deputy Field Supervisor

DEPARTMENT OF DEFENSE

Department of the Navy

Record of Decision for Proposed Future Military Operational Increases and Implementation of Associated Comprehensive Land Use Management Plan and Integrated Natural Resources Management Plan, China Lake, CA

AGENCY: Department of the Navy, DOD.

ACTION: Notice of record of decision.

SUMMARY: The Department of the Navy announces its decision to support future military operational increases and implementation of the associated Comprehensive Land Use Management Plan (CLUMP) and Integrated Natural Resources Management Plan (INRMP) at Naval Air Weapons Station (NAWS) China Lake, CA.

FOR FURTHER INFORMATION CONTACT: Commander, NAWS-Code N45NCW, 429 East Bowen Road, MS 4014, China Lake, CA 93555–6108 (Attn: Mr. John O'Gara); phone (760) 939–3213; facsimile (760) 939–2980; or E-Mail: *john.ogara@navy.mil.*

SUPPLEMENTARY INFORMATION: Pursuant to Section 102(2)(c) of the National Environmental Policy Act (NEPA) of 1969 (42 U.S.C. § 4321 *et seq.*); Council on Environmental Quality (CEQ) regulations (40 CFR Parts 1500–1508); and Department of the Navy regulations (32 CFR 775), the Department of the Navy (Navy) announces its decision to support future military operational increases and implementation of the associated CLUMP and INRMP at NAWS China Lake, CA. This will be accomplished as set out in the Moderate Expansion Alternative as described in the Final Environmental Impact Statement (EIS). This decision will enable the Navy to meet its established mission to support state-of-the-art air warfare weapons systems testing and evaluation and the operational readiness of the military services on both existing facilities and infrastructure and safe, operationally realistic, and thoroughly instrumented land ranges.

Background and Issues: As the Navy's full-spectrum Research, Development, Test, and Evaluation (RDT&E) center for weapons systems associated with air warfare, aircraft weapons integration, missiles and missile subsystems, and assigned airborne electronic warfare systems, NAWS China Lake is host to the Naval Air Warfare Center Weapons Division (NAWCWD) and other DOD activities. To support NAWCWD's RDT&E mission and military readiness training, NAWS China Lake schedules, controls, and maintains 1.1 million acres of fully instrumented land ranges.

Continued use of these land ranges requires compliance with the California Desert Protection Act of 1994 and the Sikes Act, as amended in 1997. Implementation of the CLUMP and the INRMP will enable NAWS China Lake to beneficially manage environmental, land, and cultural resources such that there is no net loss in the capability of the installation to support its existing military mission. These plans will also facilitate environmentally sound resource management decisions when responding to planned increases in and emerging military readiness needs.

Alternatives Considered: A screening process, based upon criteria set out in the Final EIS, was conducted to identify a reasonable range of alternatives that would satisfy the Navy's purpose and need. Two operational alternatives and the no action alternative were analyzed in detail in the Final EIS.

The preferred alternative is the Moderate Expansion Alternative, which provides NAWS China Lake with the greatest flexibility to accommodate evolving Navy and DOD Test and Evaluation (T&E) and operational readiness needs. This alternative involves phasing future military operational increases over a five-year period, according to operational needs. These operational increases would include: a 25-percent increase over the type and tempo of current range flight operations, airfield flight operations, range ground operations; and, an increase in range supersonic flights from 36 to 100 operations per year. An increase in ground troop training exercises from 22 to 42 events per year is also proposed. Nonmilitary activities would continue according to current patterns of use. The implementation of the CLUMP and INRMP would provide for the sound management of land use and environmental resources to accommodate future moderate operational increases.

The Limited Expansion Alternative also provides for a five-year phase-in of increased military operations at NAWS China Lake, in accordance with operational needs. However, military operational increases would be less than those proposed under the Moderate Expansion Alternative, and would include: a 15-percent increase over the type and tempo of current range flight operations, airfield flight operations, range ground operations; and, an increase in range supersonic flights from 36 to 100 operations per year. An increase in ground troop training exercises from 22 to 41 events per year is also proposed. Nonmilitary activities would continue according to current patterns of use. The implementation of the CLUMP and INRMP would provide for the sound management of land use and environmental resources to accommodate future limited operational increases.

Under the No Action Alternative, existing operating conditions at NAWS China Lake would be maintained at current levels as set forth in the Final EIS. Nonmilitary activities would continue according to current patterns of use. As required by law, the CLUMP and INRMP would be implemented under this alternative to provide for the management of land use and environmental resources to accommodate the type, tempo, and location of military T&E and training operations currently conducted at NAWS China Lake. The No Action Alternative is the environmentally preferred alternative because it involves the least amount of change to the physical environment.

Environmental Impacts: Potential environmental impacts associated with the three alternatives were analyzed in the Final EIS. Because on-going and future operational increases will continue to occur in range areas that have been previously disturbed (including those areas that may have been underutilized in the recent past), and the objectives of the CLUMP and INRMP are to institute land use and environmental management practices that minimize the potential for adverse effects, no significant environmental impacts were identified to any of the resource areas. Consequently, no mitigation measures are proposed.

The CLUMP will be implemented in accordance with the 1994 Memorandum of Agreement between the Secretary of the Interior and the Secretary of the Navy regarding the management of withdrawn lands at NAWS China Lake. Implementation of the CLUMP and INRMP will result in beneficial impacts at NAWS by standardizing baseline data for land use patterns and environmental resources using electronic mapping technology (Geographic Information Systems), and formalizing and integrating the station's environmental review process with facility, infrastructure, and operational planning processes. CLUMP implementation will facilitate the environmental reviews of on-going and proposed military test and training activities, potential facilities construction, operation and maintenance efforts and related support activities, and nonmilitary uses. Information regarding other Federal regulatory processes associated with this action is presented below.

The Navy initiated formal consultation under Section 7 of the Endangered Species Act with the U.S. Fish and Wildlife Service (USFWS) in 1990, 1995, and 1997, respectively, for each of the three protected wildlife species occurring at China Lake: the Inyo California towhee, the desert tortoise, and the Mojave tui chub. The USFWS issued Biological Opinions (BOs) for the three species that cover a range of actions from habitat maintenance and enhancement, to a programmatic BO for the desert tortoise encompassing established military operations conducted in tortoise habitat on NAWS. The Navy has determined that the preferred alternative is consistent with the terms and conditions of the existing BOs and would not adversely affect Federally listed species. USFWS has confirmed this conclusion through informal consultation with NAWS throughout the NEPA process.

NAWS China Lake employs a phased approach to compliance with Section 106 of the National Historic Preservation Act (NHPA) (16 U.S.C. 470). The California State Historic Preservation Officer (SHPO) has concurred that the NAWS approach is consistent with NHPA regulations. In addition, a draft Programmatic Agreement (PA) has been developed to facilitate the protection of cultural resources. This PA will be finalized through formal consultation in accordance with comments received from the California SHPO and area Tribes. NAWS China Lake will continue to implement appropriate management plans and procedures to ensure compliance with the NHPA, and to consult and coordinate (as appropriate) with the California SHPO and area Tribes.

Response To Comments Received Regarding the Final EIS: The Final EIS was distributed to government agencies and the public on March 05, 2004, for a 30-day public review period. During this period only two comment letters were received, both from private landowners in the vicinity of NAWS China Lake. The comments identified concerns related to air quality, range safety, potential seismic events, off-station land uses, access to station property, airspace management, and aircraft operations. Some of the comments are not related to the proposed action or the Final EIS and would be more appropriately directed toward local civil authorities or the NAWS China Lake Public Affairs Office. No new substantive issues concerning the proposed action were raised in the comments received. All of the issues raised in comment letters were thoroughly analyzed and discussed in the Final EIS.

Conclusions: After carefully considering the purpose and need for the proposed action, the analyses contained in the Final EIS, and the comments received on the Draft and Final EIS from Federal, state, and local agencies, non-governmental organizations, and individual members of the public, I have determined that the preferred alternative, the Moderate Expansion Alternative, will best meet the needs of the Navy.

Implementation of the Moderate Expansion Alternative will enhance the existing assets and capabilities of NAWS China Lake; provide for meeting current and evolving Navy and DOD operational, testing, and training requirements; and achieve Navy compliance with the California Desert Protection Act of 1994 and the Sikes Act, as amended in 1997.

Dated: May 19, 2004.

Donald R. Schregardus,

Deputy Assistant Secretary of the Navy (Environment).

[FR Doc. 04–11906 Filed 5–25–04; 8:45 am]

BILLING CODE 3810–FF–P

DEPARTMENT OF EDUCATION

Submission for OMB Review; Comment Request

AGENCY: Department of Education.

SUMMARY: The Leader, Regulatory Information Management Group, Office of the Chief Information Officer invites comments on the submission for OMB review as required by the Paperwork Reduction Act of 1995.

DATES: Interested persons are invited to submit comments on or before June 25, 2004.

ADDRESSES: Written comments should be addressed to the Office of Information and Regulatory Affairs, Attention: Alice Thaler, Desk Officer, Department of Education, Office of Management and Budget, 725 17th Street, NW., Room 10222, New Executive Office Building, Washington, DC 20503 or faxed to (202) 395–6974.

SUPPLEMENTARY INFORMATION: Section 3506 of the Paperwork Reduction Act of 1995 (44 U.S.C. chapter 35) requires that the Office of Management and Budget (OMB) provide interested Federal agencies and the public an early opportunity to comment on information collection requests. OMB may amend or waive the requirement for public consultation to the extent that public participation in the approval process would defeat the purpose of the information collection, violate State or Federal law, or substantially interfere with any agency's ability to perform its statutory obligations. The Leader, Regulatory Information Management Group, Office of the Chief Information Officer, publishes that notice containing proposed information collection requests prior to submission of these requests to OMB. Each proposed information collection, grouped by office, contains the following: (1) Type of review requested, *e.g.*, new, revision, extension, existing or reinstatement; (2) Title; (3) Summary of the collection; (4) Description of the need for, and proposed use of, the information; (5) Respondents and frequency of collection; and (6) Reporting and/or Recordkeeping burden. OMB invites public comment.

Dated: May 20, 2004.

Angela C. Arrington,

Leader, Regulatory Information Management Group, Office of the Chief Information Officer.

Office of Special Education and Rehabilitative Services

Type of Review: Extension.

Title: Assurances for the Protection and Advocacy for Assistive Technology (PAAT) Program.

Frequency: Periodically.

Affected Public: Not-for-profit institutions; State, local, or tribal gov't, SEAs or LEAs.

Reporting and Recordkeeping Hour Burden:

Responses: 1.

Burden Hours: 9.

Abstract: This document will be used by grantees to request funds to carry out the PAAT program. PAAT is mandated by the Assistive Technology Act of 1998, to provide protection and advocacy services to individuals with disabilities for the purposes of assisting in the acquisition, utilization, or maintenance of assistive technology or assistive technology services.

Requests for copies of the submission for OMB review; comment request may be accessed from *http://edicsweb.ed.gov,* by selecting the ''Browse Pending Collections'' link and by clicking on link number 2471. When you access the information collection, click on ''Download Attachments'' to view. Written requests for information should be addressed to Department of Education, 400 Maryland Avenue, SW., Potomac Center, 9th Floor, Washington, DC 20202–4700. Requests may also be electronically mailed to the Internet address *OCIO_RIMG@ed.gov* or faxed to 202–245–6623. Please specify the complete title of the information collection when making your request.

9563

USDA, Forest Service

OMB 0596-0217
FS-1500-6

FS Agreement No. 11-IA-11051345-004
DOD Agreement No. N47609-110314-N30-MAA

INTERAGENCY AGREEMENT
Between The
United States Department of Defense
COMMANDER, NAVY REGION SOUTHWEST
NAVAL AIR WEAPONS STATION CHINA LAKE
FIRE AND EMERGENCY SERVICES
And The
United States Department of Agriculture
Forest Service
SEQUOIA NATIONAL FOREST

This INTERAGENCY AGREEMENT is hereby made and entered into by and between the Commander, Navy Region Southwest, Naval Air Weapons Station China Lake, Fire & Emergency Services at Naval Air Weapons Station China Lake, hereinafter referred to as NRSW F&ES and the USDA, Forest Service Sequoia National Forest, hereinafter referred to as the "U.S. Forest Service," under the authority and provisions of: The Economy Act of June 30, 1932 (31 USC 1535, P.L. 97-258 and 98-216), and Reciprocal Fire Protection Act of May 27, 1955 (42 U.S.C. 1856a).

Background:

Wildland fire management, suppression and safety are of national importance and are an ongoing concern of the American public. Considerable cooperation and coordination already exists among the Department of Agriculture (USDA), and the Department of Defense (DoD) for discharging these responsibilities.

I. PURPOSE

The purpose of this Agreement is to document the cooperation between the Parties in the prevention, detection and suppression of wildland fires, and fuels treatments and prescribed burning within the protection areas of Parties signatory to this Agreement.

The U.S. Forest Service has the responsibility for prevention, protection and suppression of wildland fires on National Forest administered lands, and on adjacent or intermingled State and private forested lands as identified through written agreement.

The NRSW F&ES has the responsibility for prevention, protection and suppression of structure, wildland and other non-wildland fires within the established base. These lands are intermingled or adjacent to lands protected by the U.S. Forest Service.

It is mutually advantageous, and in the public interest, for the Parties to coordinate their efforts in the prevention, detection, and suppression of wildfires in and adjacent to their areas of responsibility.

This Agreement describes the conditions in which "mutual aid" periods are established to provide resources to each other on a non-reimbursable basis. This Agreement also describes the conditions of "Assistance by Hire" on a reimbursable basis.

II. DEFINITIONS

See **Exhibit A** for complete list of definitions

PROTECTING PARTY: The PARTY responsible for providing direct wildland fire protection to a given area pursuant to this agreement

SUPPORTING PARTY: The Party directly contributing suppression, rescue, support or service resources to the Party possessing direct fire protection responsibility for the area upon which an incident is located

III. THE NRSW F&ES SHALL:

A. Perform in accordance with the terms of this Agreement and Annual Operating Plan

B. IPAC BILLING INFORMATION (DOD). Any payment to the U.S. Forest Service must be through an Interagency Payment and Collection System (IPAC) billing. The Forest Service will provide a detailed list of charges incurred upon request.

The U.S. Forest Service will prepare the IPAC billing. It must contain the following DOD payment information for processing:

BILLING DATA	DOD
Obligation Document Number	
Agency Location Code (ALC)	97200011
Treasury Account Symbol (TAS)	17
Account/Cost Structure	
Budget Object Code (BOC)	2510
Document Agreement Number	
Data Universal Numbering System number (DUNS)	DODN00242
Business Event Type Code (BETC)	DISB

IV. THE U.S. FOREST SERVICE SHALL:

A. Perform in accordance with the terms of this Agreement and Annual Operating Plan

B. IPAC BILLING INFORMATION (FS): Any payment to the Commander, Navy Region Southwest must be through the Interagency Payment and Collection System (IPAC) billing. A detailed list of expenditures must be made available upon request. To facilitate processing the IPAC payment by the Forest Service, the MO Number and Line Number should be placed in the Purchase Order Number block on the IPAC bill in the following format: MOXXXXXXXXX#YYY (where X is the MO number and Y is the Line Number).

The IPAC billing document which Commander, Navy Region Southwest prepare(s) must contain the following information:

BILLING DATA	U.S. FOREST SERVICE
Obligation Document Number (MO# and Line Number)	Provided prior to billing
Agency Location Code (ALC)	12-40-1100
Treasury Account Symbol (TAS)	
Job Code/Override	
Budget Object Code (BOC)	2510
Document Agreement Number	11-IA-11051345-004
Data Universal Numbering System (DUNS)	92-9332484
Business Event Type Code (BETC)	DISB

V. IT IS MUTUALLY AGREED AND UNDERSTOOD BY AND BETWEEN THE PARTIES THAT:

1. **ANNUAL OPERATING PLANS** (Exhibit B) The Parties will meet annually, prior to the initiation of fire season, to review and update, if necessary, the Annual Operating Plan (AOP). This AOP will include protection area maps for all Parties, lists of principal personnel, dispatching procedures, and any other items identified in this Agreement as necessary for efficient implementation. This AOP shall become attached to and made a part of this Agreement.

2. **MUTUAL AID PERIOD** As deemed appropriate, the Parties may establish reciprocal initial attack areas for lands of intermingled or adjoining protection responsibilities. Within such areas the SUPPORTING Party will, upon request or voluntarily, take initial attack action in support of the PROTECTING Party. The

PROTECTING Party will not be required to reimburse the SUPPORTING Party for initial attack actions taking place in these areas within the first **(NOT APPLICABLE)** hours following initial dispatch of suppression resources. All assistance beyond this mutual aid period will be Assistance by Hire and will be billed retroactively for the full period from the time of initial dispatch. Reciprocal initial attack will follow the guidelines specified in the attached AOP.

3. **REQUESTED ASSISTANCE** Outside initial attack areas, when requested by the PROTECTING Party, the SUPPORTING Party will, within their capability, provide initial action or other support on wildland fires. Such requested assistance is reimbursable.

4. **ASSISTANCE BY HIRE** Assistance by Hire is the provision of fire suppression resources, by one to another, on a reimbursement basis. All requests to hire fire protection assistance must be clear and precise and shall be processed and recorded through the dispatching systems of the Parties. Requests not processed in this manner will not be reimbursed. Personnel, equipment, supplies or services provided by the SUPPORTING Party and essential to filling the resource order, which are necessary and reasonable, shall be considered as reimbursable as Assistance by Hire. The NRSW F&ES may provide out-of-state assistance to the U.S. Forest Service when requested. Such assistance will be Assistance-by-Hire unless otherwise specified as mutual aid in the AOP pursuant to this agreement.

   Except for Mutual Aid, all requests for fire suppression assistance in either Party's DPA shall be Assistance by Hire. Any other resources provided by the SUPPORTING Party, and not specifically ordered by the PROTECTING Party, shall be considered a voluntary contribution and not reimbursed under the terms of this agreement.

5. **INDEPENDENT ACTION** Except as otherwise described in the AOP, any Party on its own initiative and without reimbursement may go upon lands protected by the other Party to suppress wildfires, if the fire is a threat to property within that Party's protection responsibility. In such instances, the Party taking action will promptly notify the PROTECTING Party.

   If either Party takes action on a fire independently, the SUPPORTING Party will furnish the PROTECTING Party a preliminary report (oral) within 24 hours of the action taken and a written incident report with 10 days.

6. **CLOSEST FORCES** The Parties agree to aggressively pursue initial attack plans that utilize "Closest Forces" wherever appropriate, and to identify preplanned initial attack areas within their respective jurisdictions. This philosophy dictates that the closest available resources, regardless of ownership, shall be utilized initially. The emphasis to get the closest resources to respond to initial attack fires is in the best interest of all Parties.

7. **NOTIFICATIONS** Each Party will promptly notify the PROTECTING Party of fires burning on or threatening lands for which that Party has protection responsibility. When taking action, the SUPPORTING Party will, as soon as possible, notify the PROTECTING Party in accordance with the AOP; detailing what equipment and personnel have been dispatched to the incident location.

8. **BOUNDARY LINE FIRES** Boundary line fires will be the initial attack responsibility of the PROTECTING Parties on either side of the boundary. Neither Party will assume the other is aware of the fire, or is taking action. The officer-in-charge who arrives first at the fire will act as Incident Commander. When both Parties have arrived, it will be mutually agreed to the designation of the Incident Commander or the initiation of a Unified Command Structure.

9. **COST SHARING** On multi-jurisdictional incidents and incidents which threaten or burn across direct protection boundaries, the Parties will jointly develop and execute a written cost share Agreement which describes a fair distribution of financial responsibilities. Billing timeframes are dictated by the cost share agreement.

10. **COMMUNICATION SYSTEMS** The Parties agree to share the use of communication systems, radios and radio frequencies for the execution of this Agreement. Sharing of frequencies must be approved only by authorized personnel for each Party and documented in the AOP.

11. **REPLACEMENT OF FIRE SUPPLIES** Replacement of Party-owned supplies that are lost, damaged, or expended may be re-supplied at the incident prior to demobilization and according to established procedures. Items not available at the incident will be documented and an "S" number will be issued to authorize replacement after the resource leaves the incident.

12. **PRESERVATION OF EVIDENCE** The Parties will attempt to protect the point of origin of the fire and evidence pertaining to the fire cause.

13. **TRAINING** The Parties will cooperate to insure that jointly provided training will produce safe and effective fire and aviation programs. The intent is to provide high quality training that will minimize training costs by sharing of resources, standardization of courses, improve firefighting efficiency and safety. Training also includes participation of fire team members at annual Incident Management Team meetings so members can maintain competency for their specific positions. Each Party will bear the cost of training for their respective employees unless specifically addressed in the AOP.

14. **FIRE TRAINING CENTERS** The Parties agree to reimburse (or bill) for fire training rendered at training center(s). Billing and reimbursement procedures for this training will use the process identified at the respective fire training facility.

Reimbursement and billing arrangements for the rent of either Party's training facilities is also considered part of this Agreement and billings will also be processed as identified by each training facility.

15. **FIRE RESTRICTIONS AND CLOSURES** Parties will coordinate restrictions and closures.

16. **NATIONAL EMERGENCIES** The Parties to this Agreement may respond upon request to National declared emergencies providing there are no statutory prohibitions against such use.

17. **FUNDING LIMITATION** Nothing herein shall be considered as obligating either Party to expend, or as involving either in any contract or other obligation for the future payment of, money in excess of funding approved and made available for payment under this Agreement and any modification thereto.

18. **NATIONAL INTERAGENCY INCIDENT MANAGEMENT SYSTEM** The Parties to this Agreement will operate under the concepts defined in the National Interagency Incident Management System (NIMS) including: Incident Command System (ICS), qualifications system, certification system, training system, the management of publications, and participate in the review, exchange, and transfer of technology as appropriate for providing qualified resources, and for the management of incidents covered by this Agreement.

19. **FIREFIGHTER & OVERHEAD QUALIFICATIONS** U.S. Forest Service agrees to send qualified personnel who meet all the position requirements specified in FSH 5109.17 (meets or exceeds PMS 310-1) to any NRSW F&ES incident. The NRSW F&ES agrees to send qualified personnel who meet the training and qualification standards specified in National Wildfire Coordinating Group's (NWCG) PMS 310-1 to any U.S. Forest Service incident, IMT assignment or overhead request.

20. **PERSONAL PROTECTIVE EQUIPMENT** The Parties agree to provide their respective responding personnel with approved personal protective equipment (PPE) suitable for the assignment. In the case of U.S. Forest Service resources, NFPA standards apply in wildland fire situations.

21. **LAW ENFORCEMENT** Law enforcement efforts shall be coordinated to the maximum extent possible, at all levels by all Parties. The Parties shall render mutual assistance in law enforcement activities and the gathering of evidence, and in actual court prosecutions to the fullest extent practicable.

22. **EQUIPMENT** The Party that owns the equipment is responsible for the operation, service, and repair of such equipment. The PROTECTING Party shall pay or reimburse for damages in excess of normal wear and tear, and shall replace

or reimburse items lost or destroyed, except for damages occurring as a result of negligence by the SUPPORTING Party.

23. **WAIVER OF CLAIMS AGAINST THE PARTIES** The Federal agencies hereby waive all claims between and against each other for compensation for loss, damage, and personal injury, including death, to each other's property, employees, agents, and contractors occurring in the performance of this agreement.

24. **ACCIDENT INVESTIGATIONS** Whenever an accident occurs involving the equipment or personnel of a SUPPORTING Party, the PROTECTING Party shall take immediate steps to notify the SUPPORTING Party that an accident has occurred. As soon as practical, the PROTECTING Party shall initiate an investigation of the accident. A team made up of appropriate representatives from all affected agencies shall conduct the investigation. Costs for investigation personnel are Party-specific and will be borne by the sending Party. Other accident or incident investigation costs are the fiscal responsibility of the (IES) that has jurisdiction and/or investigative responsibility. The sharing of information between Parties on accident investigations and their findings and probable causes is a valuable tool for safety and must be encouraged.

25. **PREVIOUS AGREEMENTS CANCELED** This Agreement supersedes and cancels any prior Cooperative Fire Protection or Interagency Agreement for fire protection between the Parties.

26. **TERMINATION** This interagency agreement may be terminated upon 30 calendar days written notice by either party. If this agreement is cancelled, any implementing contract/order may also be cancelled. If the interagency agreement is terminated, the agencies shall agree to the terms of the termination, including costs attributable to each party and the disposition of awarded and pending actions. If the Servicing Agency incurs costs due to the Requesting Agency's failure to give the requisite notice of its intent to terminate the interagency agreement, the Requesting Agency shall pay any actual costs incurred by the Servicing Agency as a result of the delay in notification, provided such costs are directly attributable to the failure to give notice.

27. **MODIFICATIONS** Modifications within the scope of the instrument must be made by mutual consent of the parties, by the issuance of a written modification, signed and dated by all properly authorized, signatory officials, prior to any changes being performed. Requests for modifications should be made, in writing, at least 60 days prior to implementation of the requested change. The U.S. Forest Service is not obligated to fund any changes not properly approved in advance.

28. **COMMENCEMENT/EXPIRATION DATE** This instrument is executed as of the date of last signature and is effective for five years from that date, at which time it will expire unless extended.

29. **ALTERNATE DISPUTE RESOLUTION** The parties to this agreement shall settle any disputes that may arise under this agreement by following direction in the Treasury Financial Manual, Volume 1, Bulletin 2007-03, Section VII ("Resolving Intragovernmental Disputes and Major Differences").

30. **PRINCIPAL CONTACTS**. Individuals listed below are authorized to act in their respective areas for matters related to this instrument.

Principal DOD Contacts:

DOD Program Contact	DOD Administrative Contact
J.A Wood, Regional Fire Chief 937 N. Harbor Drive, Box 74 San Diego CA 92138-1226 Telephone: 619-532-1874 FAX: 619-532-1678 Email: jaimie.wood@navy.mil	Bruce Cargal NAWS China Lake Code 3000IN China Lake CA 93555-6100 Telephone: 760-939-4830 FAX: 760-939-4613 Email: bruce.cargal@navy.mil

Principal U.S. Forest Service Contacts:

U.S. Forest Service Program Contact	U.S. Forest Service Administrative Contact
Steve Phillips 2750 Yowlumne Suite B Porterville CA 93257 Telephone: 559-782-3120 FAX: 559-781-3320 Email: sjphillips@fs.fed.us	Teresa Porter 1600 Tollhouse Road Clovis, CA 93611 Telephone: 559-297-0706 x 4843 FAX: 559-294-4833 Email: tporter@fs.fed.us

31. **AUTHORIZED REPRESENTATIVES.** By signature below, each party certifies that the individuals listed in this document as representatives of the individual parties are authorized to act in their respective areas for matters related to this instrument. In witness whereof, the Parties hereto have executed this instrument as of the last date written below.

J.A. DODSON CAPT USN, Commanding Officer Naval Air Weapons Station China Lake	5/20/11 Date
J.A. WOOD, Fire Chief/Program Manager Fire & Emergency Services Navy Region Southwest	8 APR 11 Date
DEBRA L. WHITMAN, Acting Forest Supervisor U.S. Forest Service, Sequoia National Forest	6/22/11 Date

The authority and format of this instrument has been reviewed and approved for signature.

LYNNE SHOLTY
U.S. Forest Service Grants & Agreements Specialist

4/1/11
Date

Burden Statement

According to the Paperwork Reduction Act of 1995, an agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information collection is 0596-0217. The time required to complete this information collection is estimated to average 4 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or part of an individual's income is derived from any public assistance. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at 202-720-2600 (voice and TDD).

To file a complaint of discrimination, write USDA, Director, Office of Civil Rights, 1400 Independence Avenue, SW, Washington, DC 20250-9410 or call toll free (866) 632-9992 (voice). TDD users can contact USDA through local relay or the Federal relay at (800) 877-8339 (TDD) or (866) 377-8642 (relay voice). USDA is an equal opportunity provider and employer.

COOPERATIVE FIRE PROTECTION AGREEMENT
EXHIBIT A
DEFINITIONS

ADMINISTRATIVE RATE: That pre-established percentage charge that will be applied by the billing PARTY.

AIRCRAFT: Any firefighting fixed or rotary-winged aircraft owned or contracted exclusively to the DOD or Forest Service.

ASSISTANCE BY HIRE: Fire suppression resources and associated support resources needed to fill the incident order that are to be paid for by the PROTECTING Party. Terms of the agreement establish the reimbursement rates.

AVAILABLE: Following the Incident Command System protocols, the status of a fire fighting resource that indicates its availability for assignment on an incident.

BACKFILLING: The act of providing cover staffing at the station or administrative site that has been vacated by the resources provided to the incident

BOUNDARY FIRE: A fire burning on or directly adjacent to the Direct Protection Boundary between the DOD and the Forest Service.

CLOSEST FORCES CONCEPT: The philosophy of committing the closest available appropriate resources, regardless of ownership, as described in the Annual Operating Plan, to a wildfire for initial attack or for critical need.

COOPERATIVE FIRE PROTECTION: Specific fire protection services furnished by one party to the other on a reimbursable basis pursuant to the Annual Operation Plan.

COST SHARE AGREEMENT: An interagency agreement describing the conditions and/or percentage of DOD and Forest Service financial responsibility for costs incurred as a result of jointly approved operations pursuant to the terms of this agreement.

DETECTION: The act or system of discovering and locating a fire.

DIRECT PROTECTION AREA (DPA): That area which, by law or pursuant to the terms of this agreement, is provided wildland fire protection by the DOD or by the Forest Service. DPAs may include a mixture of DOD and Forest Service responsibility areas.

DIRECT PROTECTION AREA MAPS: Official maps which identify areas of direct wildland fire protection for each Party.

FIRE HELICOPTER: A rotary wing aircraft provided by the DOD or the Forest Service for planned availability and initial attack fire response.

FIRE PREVENTION: Activities directed at reducing the number of fires that start, including public education, law enforcement, dissemination of information, and the reduction of hazards through engineering methods.

FIRESCOPE (Firefighting Resources of California for Potential Emergencies): A cooperative effort involving all agencies with fire fighting responsibilities in California. Organized to create and implement new applications in fire service management, technology and coordination, with an emphasis on incident command and multi-agency coordination.

HANDCREW: A wildland fire suppression crew consisting of approximately 15 to 20 persons.

HELITACK: A fire fighting module consisting of a "fire helicopter", helitender, and fire fighting crew. The number of personnel in the crew may vary.

HOSTING UNIT: The organization or area responsible for the incident or the area where the incident occurs.

INCIDENT: An occurrence or event, either human-caused or natural phenomenon that requires action by emergency service personnel to prevent or minimize loss of life or damage to property and/or natural resources.

INITIAL ATTACK: Resources initially committed to an incident.

JURISDICTIONAL PARTY: The party which has overall land and resource management and/or protection responsibility as provided by law.

LINE OFFICER/AGENCY REPRESENTATIVE: A Supporting Party employee with full authority to make decisions on all matters affecting that Party's participation at the incident.

MOVE-UP AND COVER: Identifies a relocation of fire suppression resources from their established location to a temporary location to provide fire protection coverage for an initial attack response area.

MUTUAL AID: Automatic initial attack response by suppression resources (excluding aircraft and pilot[s]) as specified in the Operating Plan for specific pre-planned initial attack response areas and provided at no cost to the PROTECTING Party for the first specified hours from the time of initial report. Mutual Aid is limited to those Initial Attack resources or move-up and cover assignments that have been determined to be appropriate in the annual Operating Plans. Aircraft (fixed and rotary-winged, including pilot[s]) shall always be Assistance by Hire, EXCEPT when the response is under a unified command and the fire threatens both local and federal jurisdictions. Fiscal

responsibility for all aircraft will be determined by the ordering process, utilization and cost share agreements.

PRESCRIBED FIRE: The planned use of fire on wildlands to accomplish specific objectives including reducing fire hazard, providing flood protection, enhancing wildlife and fisheries, or improving water yields and/or air quality.

PROTECTING PARTY: The PARTY responsible for providing direct wildland fire protection to a given area pursuant to this agreement.

REIMBURSABLE WORK: Reinforcements exceeding reciprocal fire protection services furnished by either Party, at the request of the other, or fire protection furnished as a chargeable cooperative fire protection service

REPAIR OF SUPPRESSION ACTIVITY DAMAGE: Those activities undertaken by fire suppression forces during or immediately after the control of a wildfire to insure the prevention of erosion or to repair other damages resulting from fire suppression activities.

SUPPORTING PARTY: The Party directly contributing suppression, rescue, support or service resources to the Party possessing direct fire protection responsibility for the area upon which an incident is located.

SUPPRESSION: All the work of confining and extinguishing a fire beginning with its discovery.

UNIFIED COMMAND: The organizational structure implemented on multi-jurisdictional incidents. The Parties' Incident Commanders will jointly determine incident objectives.

WILDFIRE: An unwanted fire burning uncontrolled on wildland.

WILDLAND: Lands covered wholly or in part by timber, brush, grass, grain, or other flammable vegetation.

DEPARTMENT OF THE NAVY
OFFICE OF THE CHIEF OF NAVAL OPERATIONS
2000 NAVY PENTAGON
WASHINGTON, D.C. 20350-2000

IN REPLY REFER TO

5090
Ser N456M/1U595820
10 JAN 2002

From: Chief of Naval Operations

Subj: POLICY LETTER PREVENTING FERAL CAT AND DOG POPULATIONS ON NAVY PROPERTY

Ref: (a) SECNAVINST 6401-1A, of 16 Aug 94, Veterinary Health Services
(b) AFPMB TIM #37, Guidelines for Reducing Feral/Stray Cat Populations on Military Installations in the United States
(c) OPNAVINST 6250.4B, dtd 27 Aug. 1998, Pest Management Programs
(d) Executive Order 13112 of 3 Feb 1999, Invasive Species

1. This letter clarifies the application of reference (a) regarding the prevention of free roaming (also called wild, feral or stray) cat and dog populations on Navy installations. The objective is to prevent injury or disease to Navy personnel, and eliminate adverse impacts on native wildlife. It requires Navy commands to institute pro-active pet management procedures in order to prevent establishment of free roaming cat and dog populations. Free roaming cats and dogs pose a potential public health threat to personnel on Navy installations, and they pose a threat to wildlife including endangered species and migratory birds.

2. Existing policy at Paragraph 4-2c(4) of reference (a) states "Dogs, cats, and other privately-owned or stray animals will not be permitted to run at large on military reservations." Consistent with this policy, Navy commands must ensure the humane capture and removal of free roaming cats and dogs. Consistent with this requirement, Trap/Neuter/Release (TNR) programs will no longer be established on Navy land. All existing TNR programs on Navy land must be terminated no later than 1 January 2003.

3. Responsible pet ownership is a key factor in eliminating free roaming cat and dog populations. In consultation with supporting Army Veterinary Office, installations shall implement appropriate pet management measures to preclude establishment

of feral cat/dog populations, including, but not limited to the following:

Require installation residents to keep and feed pet animals indoors or under close supervision when outdoors (such as on leash and collar or other physical control device - cage, fenced yard etc.).

Encourage neutering or spaying of cats and dogs before they reach reproductive age (exceptions to this policy can be made on a case by case basis as determined by the Installation Commander).

Require routine vaccinations of cats and dogs for rabies and other diseases as required by federal, state and local laws and ordnances. A current vaccination record is required at time of registration of pets.

Require microchipping registration (or other system of pet identification approved by supporting veterinary office) of all pet cats and dogs brought onto installations. Installation residents must register cats and dogs and have pets wear registration or identification tags at all times.

Prohibit the feeding of feral animals on the installation.

Provide educational materials to pet owners regarding installation regulations and general pet management.

Enforce prohibition of abandonment of animals on installations.

Comply with all humane and animal control regulations at the federal, state and local level (and their equivalents in host nation countries).

Navy installations in Europe that do not have a supporting veterinary office contact 100th Medical Detachment (VA HQ) (011) 49-622-177-2868; for all other locations that do not have a supporting veterinary office the POC is the VETCOM HQ, Commander (210) 221-6522.

Subj: POLICY LETTER PREVENTING FERAL CAT AND DOG POPULATIONS ON NAVY PROPERTY

4. Effective prevention, management and elimination of feral cat and dog populations requires close coordination and cooperation between natural resources, pest management, security, veterinary, and housing personnel to develop and implement an effective and humane program. Reference (b) provides information for preventing free roaming cat populations on military installations. General pest management guidelines are detailed in reference (c). Every effort should be made to work with other federal, state and local agencies to support reference (a) and reference (d) by eliminating free roaming cat and dog populations on Navy land. Navy commands should work with local animal control agencies to determine the best approach for the ultimate disposition of the captured animals. Every effort should be made, if practical, to find homes for adoptable feral cats and dogs.

5. My point of contact on this issue is Mr. Joe Cook, CNO N456M, at (703) 602-5335, or DSN 332-5335.

WILLIAM G. MATTHEIS
Deputy Director, Environmental Protection, Safety and Occupational Health Division

Distribution:
CINCLANTFLT (N465)
CINCPACFLT (N465)
COMNAVRESFOR (01E, N46)
CNR (91)
CNET (44)
COMNAVSECGRU (N443)
COMNAVTELCOM (N451)
BUMED (NEGC-EPWR)
COMNAVAIRSYSCOM (AIR.OY)
COMSPAWARSYSCOM (07-1)
COMNAVSUPSYSCOM (4A2, 421)
COMNAVSEASYSCOM (SEA 00T)
COMNAVFACENGCOM (ENV, 09)
CINCUSNAVEUR (N4, N76)
COMSC (N00EP)
COMNAVMETOCCOM (N13)

Subj: POLICY LETTER PREVENTING FERAL CAT AND DOG POPULTIONS ON NAVY PROPERTY

Distribution:
CHBUMED (NEHC-EPWR)
DIRSSP (SP20161)
ONI (411)

Copy to:
OASN (I&E)
OAGC (I&E)
CNO, N44, N46, 09BF
CMC, LFL
COMNAVREG MIDLANT
COMNAVREG SE
NTC GREAT LAKES
COMNAVRESFOR
COMNAVREG SW
COMNAVREG PEARL HARBOR
COMNAVMARIANAS
COMNAVREG NW
CNFJ
CNFK
PACNAVFACENGCOM PEARL HARBOR HI (CODE 23)
LANTNAVFACENGCOM NORFOLK VA (CODE 2032)
SOUTHWESTNAVFACENGCOM SAN DIEGO CA (CODE 03EN)
SOUTHNAVFACENGCON CHARLESTON SC (CODE 064)
ENDFLDACT NE PHILADELPHIA PA (CODE 18)
ENGFLDACT WEST SAN BRUNO CA (CODE 053)
ENGFLDACT CHES WASHINGTON DC (CODE 20E)
ENGFLDACT NW POULSBO WA (CODE 05EC4)
CO PWC GREAT LAKES
CO PWC GUAM
CO PWC JACKSONVILLE
CO PWC NORFOLK
CO PWC PEARL HARBOR
CO PWC PENSACOLA
CO PWC SAN DIEGO
CO PWC SAN FRANSICO BAY
CO PWC WASHINGTON DC
CO PWC YOKOSUKA
CO CBC PORT HUENEME
CO CBC GULFPORT
OESO
MESO
DODVSA/OTSG (Chief Animal Medicine)

COMMANDER, NAVY REGION SOUTHWEST
937 N. HARBOR DRIVE
SAN DIEGO, CA 91932

FIELD MANAGER, RIDGECREST FIELD OFFICE
BUREAU OF LAND MANAGEMENT
300 SOUTH RICHMOND ROAD
RIDGECREST, CA 93555

CNRSW
N00242-20100324-CL19
6 May 2010

MEMORANDUM OF AGREEMENT
BETWEEN
COMMANDER, NAVY REGION SOUTHWEST
AND
BUREAU OF LAND MANAGEMENT, RIDGECREST FIELD OFFICE

Subj: REMOVAL OF WILD HORSES AND BURROS

Ref: (a) California Desert Conservation Area Plan of 1980
(b) California Desert Protection Act, Public Law 103-433

1. Purpose. This Memorandum of Agreement (MOA) delineates the respective roles and responsibilities of the Commander, Navy Region Southwest at Naval Air Weapons Station (NAWS) China Lake and the Bureau of Land Management (BLM) regarding the removal of wild horses and burros found on NAWS China Lake lands. The cooperation of the agencies under this MOA supports NAWS resource conservation goals through the effective management of wild horse and burro herds on NAWS China Lake lands.

2. Background. Herds of wild horses and burros graze on lands which are administered by the BLM and NAWS China Lake, which share common jurisdictional boundary lines. In order to manage these herds, NAWS China Lake and the BLM have determined levels for the number of animals based on forage production and carrying capacity of the range which may graze without adversely affecting the natural habitat of native species, or with the mission of NAWS China Lake. Those levels were originally determined in reference (a), as amended. NAWS China Lake continues to monitor habitat parameters in order to evaluate future removal requirements. Specific management issues which must be addressed per these above land use authorities include:

a. Unencumbered execution of the mission of the United States Navy at NAWS China Lake;

b. Conservation of natural habitat and maintenance of a thriving natural ecological balance (TNEB) to the rangeland; and,

c. Safe and humane removal of the animals followed by placement of the animals with private parties.

3. Scope/Authority. Section 805(g)(4) of reference (b) states "[t]he Secretary of Navy shall be responsible for the management of wild horses and burros located on the NAWS China Lake lands and may utilize helicopters and motorized vehicles for such purposes. Such management shall be in accordance with laws applicable to such management on public lands and with an appropriate memorandum of understanding between the Secretary (Interior) and the Secretary of the Navy."

4. Agreement. NAWS China Lake and the BLM enter into this agreement and mutually agree that:

a. Responsibilities

(1) The Commander, Navy Region Southwest shall be:

(a) Responsible, in cooperation with BLM, for development of a five-year herd management and monitoring plan which reflects the goal of the Wild Free-Roaming Horse and Burro Act while protecting the mission of the NAWS China Lake;

(b) Responsible for providing security badges to BLM personnel during the planned gathering operations for the purpose of carrying out the terms of this MOA;

(c) Responsible for coordination and explanation of NAWS China Lake mission requirements to BLM personnel operating in areas where gathering functions will occur. Navy testing and mission support functions will take precedence over BLM program support operations. The schedule for access to those range areas where herd-gathering is planned shall be made known to BLM personnel in a timely manner. Arrangement for access by BLM personnel to testing ranges will be coordinated with appropriate test operations personnel to ensure the safety of all personnel and the efficiency of gathering operations;

(d) Responsible for maintaining data on herd monitoring and range habitat in order to determine TNEB of NAWS China Lake's ranges. This information shall be provided to BLM for use in preparing the annual Operating Plan;

(e) Responsible for providing financial compensation to BLM for the costs associated with the removal, preparation and placement of wild horses and burros removed from lands administered by NAWS China Lake. This compensation will be described each year in the annual Operating Plan provided by BLM. The Operating Plan shall be developed in accordance with the level of funding approved by Navy. All activities performed

pursuant to this MOA are subject to the availability of the appropriated funds and no provision of this agreement shall be interpreted to require obligation or payment of funds in violations of the Anti-Deficiency Act, 31 USC 1341; and,

(f) Responsible for completing appropriate environmental reviews and approval, to include documentation and analysis under the National Environmental Policy Act (NEPA; 42 U.S.C. Section 4321), required for horse and burro removal actions.

(2) The Bureau of Land Management shall be:

(a) Responsible for development of an annual Operating Plan in conjunction with NAWS China Lake. The Operating Plan will contain a specific agreement for each year concerning funding and reimbursement requirements and a plan of action for the herd-gathering operations. Issues to be addressed in the Operating Plan include, but are not necessarily limited to: Scope of Work and estimate that details current fiscal year costs associated with removal effort on NAWS China Lake lands; identification of animals to be gathered by number, age classes, and gathering areas; and identification of the method of gather and time of year that roundups will occur. The Operating Plan will be developed and agreed to by the Ridgecrest Field Manager on behalf of BLM and the Environmental Management Division Manager on behalf of NAWS China Lake;

(b) Responsible for the physical gathering of wild horses and burros. BLM will provide qualified personnel, through the use of statewide and interstate gathering crews and contractors to assist in the gathering operations, and the equipment required to humanely and efficiently gather animals designated for removal. The elements of this responsibility include, but are not limited to:

1. Gathering of wild horses and burros using methods including passive water/feed trapping, intensive helicopter-wrangler roping operations, and run-trap as well as other appropriate techniques. BLM will determine which method of gathering should be used in specific areas of the ranges relative to the nature of the terrain, specific type of animal, and NAWS China Lake testing operations;

2. Coordination with NAWS China Lake for site access and to ensure full compliance with all required security clearance procedures to be used by BLM personnel;

3. Coordination with NAWS China Lake on scheduling gathering operations to assure they are compatible with NAWS China Lake's mission and to ensure the safety of BLM personnel and equipment; and,

4. Adhering to all safety, security, environmental and access requirements while conducting gathering operations on NAWS China Lake.

(c) Responsible for preparation and placing of wild horses and burros into the Adopt-A-Horse or Adopt-A-Burro Programs. These responsibilities include, but are not limited to:

1. Animals which are gathered and placed into the Adopt-A-Horse or Adopt-A-Burro Program become BLM animals at the time of branding and are then the sole responsibility of BLM, including shipping the animals from the corral facilities to placement into private ownership.

2. Operating and maintenance of the 50-acre corral facility used to hold captured horses and burros for adoption.

5. Severability. If any part of this MOA is declared invalid by a court of law, the remaining provisions of the agreement shall continue to exist in full force and effect.

6. Modification. Changes and amendments may be made to this agreement by mutual written consent of both parties, and will be recorded and published as addenda to this agreement.

7. Termination and Expiration.

a. This Agreement can be terminated at any time by providing 30 days written notice to the other party.

b. The parties may add or modify Appendices to this Agreement at any time upon written consent of each party.

c. The termination date shall be five (5) years from the effective date of this Agreement. Either party can terminate this Agreement, or any of the addendums then in effect, at any time by providing 30 days written notice to the other party.

d. So long as this agreement remains in effect, the parties agree to review it once every three (3) years from the effective date to ensure compatibility with current law, regulations and pertinent land use management plans. This review will result in a determination as to whether any changes are required.

8. Waiver Of Claims.

a. NAWS China Lake and the BLM both agree to waive all claims against each other for compensation for any loss, damage, personal injury, negligence, or death, which is caused by or arises out of or in consequence of the performance of this MOA. With respect to third party claims, such claims will be processed

in accordance with the Federal Tort Claims Act. (28 U.S.C. § 1346(b)).

b. Questions of potential federal liability for injury to persons or property caused by alleged negligent acts or omissions of any Federal employees acting within the course and scope of their federal employment are governed by provisions of the Federal Tort Claims Act.

c. Both signatories agree that BLM is not acting as the agent of NAWS China Lake while performing the gathering operations described in this MOA. No agency relationship is created as a result of this MOA, except to the extent that BLM personnel are required to enter onto NAWS China Lake boundaries to perform gathering operations and abide by safety, environmental and security requirements as described herein.

9. Effective Date. This MOA will become effective upon the date of the last signature of both parties to this MOA.

J. J. Gallagher — 13 APR 2010
Comptroller — date
Navy Region Southwest

Hector A. Villalobos — date
Field Manager
Ridgecrest Field Office
Bureau of Land Management

W. D. French — 30 APR 2010
Rear Admiral, U.S. Navy — date
Commander, Navy Region Southwest

Appendix C: Environmental Assessment to the INRMP

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Final Environmental Assessment

For the Revised Integrated Natural Resources Management Plan for Naval Air Weapons Station China Lake Inyo, Kern, and San Bernardino Counties, California

June 2014

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Final Environmental Assessment

For the Revised Integrated Natural Resources Management Plan

Naval Air Weapons Station China Lake
Inyo, Kern, and San Bernardino Counties, California

Point of Contact:
Sara Yamashita U.S. Department of the Navy
Naval Facilities and Engineering Command Southwest Desert IPT
1220 Pacific Highway
San Diego, CA 92132
(619) 532-3868

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List of Acronyms and Abbreviations

Acronym/Abbreviation	Definition
AICUZ	Air Installation Compatible Use Zone
AML	Appropriate Management Level
BASH	Bird/Animal Strike Hazard
BLM	U.S. Bureau of Land Management
BMP	Best Management Practice
BO	Biological Opinion
CDFW	California Department of Fish and Wildlife
CDPA	California Desert Protection Act
CEQ	Council on Environmental Quality
CNPS	California Native Plant Society
EA	Environmental Assessment
EO	Executive Order
GIS	Geographical Information System
Herd	Centennial Horse Herd
INRMP	Integrated Natural Resources Management Plan
KGRA	Known Geothermal Resource Area
Navy	U.S. Department of Navy
NAWS-CL	Naval Air Weapons Station China Lake
NEPA	National Environmental Policy Act
USC	U.S. Code
USFWS	U.S. Fish and Wildlife Service
WHBMP	Wild Horse and Burro Management Plan

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Executive Summary

This Environmental Assessment (EA) addresses the potential environmental impacts associated with the proposed implementation of the Revised Integrated Natural Resources Management Plan (INRMP) for Naval Air Weapons Station China Lake (NAWS-CL), located in Inyo, Kern, and San Bernardino Counties, California. This EA will determine if an Environmental Impact Statement or Finding of No Significant Impact should be prepared for the implementation of the Revised INRMP. This EA has been prepared in compliance with:

- National Environmental Policy Act (NEPA) of 1969 (42 United States Code § 4321, as amended);
- Council on Environmental Quality Regulations for Implementing the Procedural Provisions of NEPA (40 Code of Federal Regulations §§ 1500-1508 [1997]);
- U.S. Department of the Navy (Navy) Procedures Implementing NEPA (32 Code of Federal Regulations Part § 775 [2004]);
- Chief of Naval Operations Guidance for preparing NEPA documents for INRMPs (Navy INRMP Guidance, April 2006); and,
- Chief of Naval Operations Instructions 5090.1D, Environmental Readiness Program Manual.

The INRMP meets statutory requirements under the Sikes Act (as amended), Public Law 105-85, Div. B Title XXIX, 18 November 1997, 111 Stat 2017-2019, 2020-2022. Under the Sikes Act (as amended), the Secretary of Defense is directed to "carry out a program to provide for the conservation and rehabilitation of natural resources on military installations." Therefore, each military installation in the United States is required to develop and implement an INRMP, unless it has been determined that the installation has an "absence of significant natural resources."

The Revised NAWS-CL INRMP is needed to address recent changes in U.S. Department of Defense and Navy guidelines; to address revised/updated approaches to the management of federally-listed and other special status species; and to integrate at NAWS-CL new natural resources management strategies developed since the 2000 INRMP was written. The purpose of the Revised INRMP is to manage for natural resources at NAWS-CL through an ecosystem-based conservation program that is consistent with the military mission of the Station.

As required by Chief of Naval Operations Instruction 5090.1D, a range of reasonable alternatives was considered and evaluated on their ability to meet the purpose and need for action, as well as the following criteria:

- Are based on the principles of ecosystem management;
- Provide for sustainable multipurpose use of natural resources;
- Maintain compliance with relevant environmental regulations;

- Provide for public access for the use of natural resources subject to safety and military security considerations;
- Establish specific natural resources management objectives and timeframes for the Proposed Action; and,
- Provide for no net loss in the capability of military lands to support the military mission of the installation.

The alternatives considered in this EA are:

- Alternative 1–Proposed Action (Preferred Alternative): Implementation of the Revised INRMP for NAWS-CL, including the Wild Horse and Burro Management Plan (WHBMP).
- Alternative 2–No Action Alternative: Retain the 2000 INRMP and Current Horse and Burro Management Strategies.

The Proposed Action would adopt the Revised INRMP and implement management strategies for a variety of resource areas. The specific projects proposed are shown in Appendix A of this EA.

Interagency cooperation contributed to the development of the Revised INRMP. As required by the Sikes Act (as amended), the Navy has prepared the Revised INRMP in cooperation with the U.S. Fish and Wildlife Service, the California Department of Fish and Wildlife, and the U.S. Bureau of Land Management to achieve mutual agreement among these parties concerning conservation, protection, and management of resources at NAWS-CL.

Table ES-1 provides a summary of environmental effects by alternative. The Proposed Action (Revised INRMP and WHBMP implementation) and No Action Alternative (2000 INRMP and Current Horse and Burro Management Strategies) would result in beneficial impacts to biological resources; water resources; and topography, geology, and soils. The Proposed Action would have no significant impact to cultural resources. The majority of proposed projects in the Revised INRMP and existing INRMP would have beneficial impacts on the environment at NAWS-CL.

Table ES-1. Summary of potential environmental effects by alternative.

Resource Area	Proposed Action: Alternative 1 Revised INRMP including the WHBMP	No Action Alternative: Retain the 2000 INRMP and Current Horse and Burro Management Strategies
Biological Resources	The Revised INRMP would have moderate benefits for vegetation communities, general wildlife populations, and special status plant and wildlife species through the implementation of enhanced monitoring and surveying of biological resources. Restoration and maintenance of native habitats would aid in the recovery of listed species and the continued functioning of ecosystems. The protection of water resources through the continued installation and maintenance of fencing around springs and the removal of invasive species would have substantial beneficial effects on biological resources. Long-term benefits to all biological resources through the maintenance of an appropriate management level for wild horses and burros. A reduction in horse and burro populations would reduce grazing pressure, forage competition, impacts from trampling and water resource degradation. The WHBMP would benefit the Centennial Horse Herd (Herd) by increasing its resiliency in the face of environmental extremes, increasing the sustainability of the Herd and by maintaining genetic diversity. No Significant Impact	The continuation of management practices under the existing INRMP would have moderate benefits for vegetation communities, general wildlife populations and special status plant and wildlife species through the implementation of enhanced monitoring and surveying of biological resources. Restoration and maintenance of native habitats would aid in the recovery of listed species and the continued functioning of ecosystems. The protection of water resources through the continued installation and maintenance of fencing around springs and the removal of invasive species would have moderate beneficial effects on biological resources. Benefits to biological resources would result through coordinated efforts with the BLM to reach and maintain the designated numbers for horse and burro populations using Current Horse and Burro Management Strategies. No Significant Impact
Water Resources	Would benefit through the continued exclusion of wild horses and burros from selected water resources. Would also receive benefits through the utilization of restorative and preventative management techniques for springs, seeps and floodplains. The maintenance of an appropriate management level for the wild horse populations and burro populations would reduce impacts to water resources in the long-term. No Significant Impact	Would benefit from the continued exclusion of wild horses and burros from selected water resources. Benefits to water resources would result through coordinated efforts with the BLM to reach and maintain the designated numbers for horse and burro populations using Current Horse and Burro Management Strategies. No Significant Impact

Table ES-1. Summary of potential environmental effects by alternative.

Resource Area	Proposed Action: Alternative 1 Revised INRMP including the WHBMP	No Action Alternative: Retain the 2000 INRMP and Current Horse and Burro Management Strategies
Topography, Geology, and Soils	Under the Revised INRMP, would receive minimal benefits through the utilization of Best Management Practices that prevent erosion, support soil stability and support geologic function of ecosystems. With the implementation of the WHBMP, there would be a reduction in the number of wild horses and burros. Soil erosion and compaction would be reduced as wild horses and burros are kept at the appropriate management level. Native soil and geologic function would benefit as the impact from the movement of hooved animals was reduced. No Significant Impact	Under the existing INRMP, would receive minimal benefits through the utilization of Best Management Practices that prevent erosion, support soil stability and support geologic function of ecosystems Benefits to soil resources would result through coordinated efforts with the BLM to reach and maintain the designated numbers for horse and burro populations using Current Horse and Burro Management Strategies. No Significant Impact
Cultural Resources	Would continue to benefit from the implementation of the consulting process currently in place at NAWS-CL. To the maximum extent possible cultural resources would continue to be avoided. The implementation of the WHBMP would reduce impacts to cultural resources at NAWS-CL. The reduction in the Herd's numbers would reduce the intensity to which horses impact previously damaged areas. No Significant Impact	Would continue to benefit from the implementation of the consulting process currently in place at NAWS-CL. To the maximum extent possible cultural resources would continue to be avoided. Cultural resources present impacts would be reduced through coordinated efforts with the BLM to reach and maintain the designated numbers for horse and burro populations using Current Horse and Burro Management Strategies. No Significant Impact

1.0 Purpose and Need

1.1 Introduction

This Environmental Assessment (EA) has been prepared by the U.S. Department of the Navy (Navy) in accordance with the National Environmental Policy Act (NEPA) of 1969 and other applicable laws. It evaluates the potential impacts that would likely be associated with the proposed implementation of the natural resources management strategies outlined in the Revised Integrated Natural Resources Management Plan (INRMP) for Naval Air Weapons Station China Lake (NAWS-CL) (Navy 2013a). This EA is intended to analyze likely environmental impacts associated with implementation of the management strategies outlined in the Revised INRMP on a conceptual level. The overall natural resources management objectives for the Revised INRMP include vegetation management, wildland fire management, fish and wildlife management, wild horse and burro management, land (including surface water) management, and outdoor recreation.

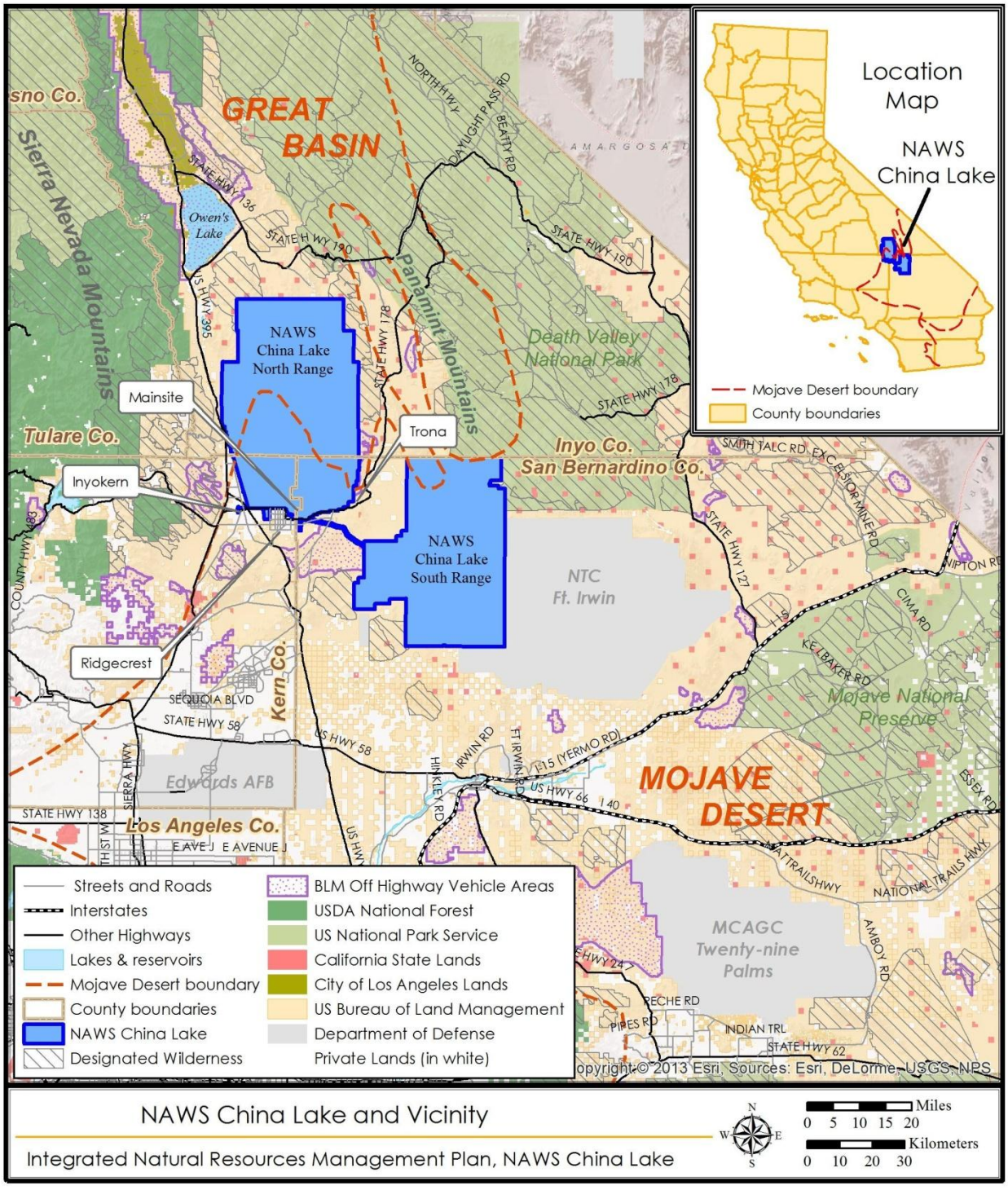
This EA analyzes two alternatives: the Proposed Action, which proposes implementation of the Revised INRMP, including the Wild Horse and Burro Management Plan, and a No Action Alternative that would continue to implement the current INRMP and maintain current approaches to wild horse and burro and other natural resources management practices.

1.2 Project Location

NAWS-CL is located in the Upper Mojave Desert of California, approximately 150 miles northeast of Los Angeles (Map 1-1). The Station is comprised of two large blocks: the North Range, portions of which are in Kern County, Inyo County, and San Bernardino County; and the South Range, which is entirely in San Bernardino County. The headquarters area, Mainsite, is located along the southern border of the North Range. The City of Ridgecrest adjoins Mainsite. Other nearby communities are Inyokern (10 miles west of Mainsite) and Trona (18 miles east of Mainsite). The Station covers 1,098,245.66 acres (1,716 square miles) of land, and is the Navy's largest land holding, representing approximately 38% of the Navy's landholdings worldwide. NAWS-CL includes a complex of laboratories and test-range facilities.

Of the 1,098,245.66 acres that NAWS-CL covers, 1,023,777 acres of this was withdrawn from public use in 1994 by the California Desert Protection Act of 1994 (16 United States Code [USC] 410aaa et. seq.). The California Desert Protection Act of 1994, which combined all prior public land withdrawal legislative actions relating to NAWS-CL into one comprehensive instrument, re-authorized the Navy's continued use of public withdrawn lands for its Research, Development, Acquisitions, Testing and Evaluation, and training mission, and allows for the accommodation of compatible nonmilitary land uses at NAWS-CL, subject to the approval of the NAWS-CL Commanding Officer. The 1994 withdrawal of public lands for Navy use at NAWS-CL was due to expire after 20 years (in 2014), subject to potential renewal. Subsequent to the

initial drafting of this EA, and pursuant to both the California Desert Protection Act of 1994 and a separate NEPA process, the Navy sought renewal of the 1994 withdrawal, and such renewed withdrawal of public lands for Navy use at NAWS-CL was approved for a further 25-year period (until 2039) with the signing of the National Defense Authorization Act for Fiscal Year 2014 on December 26, 2013.



Map 1-1. Naval Air Weapons Station China Lake regional location.

Facilities and infrastructure are located throughout the North and South Ranges. Facilities occupy approximately 8,912 acres, or 1.5% of the North Range, and 527 acres, or 0.1% of the South Range (Navy 2005).

1.3 Purpose and Need for the Project

The purpose of the Revised INRMP is to provide guidance for natural resources management at NAWS-CL through an ecosystem-based conservation program that is consistent with the military mission of the Station. The Revised NAWS-CL INRMP is needed to address recent changes in U.S. Department of Defense and Navy guidelines; to address revised/updated approaches to the management of federally-listed and other special status species; and to integrate at NAWS-CL new natural resources management strategies developed since the 2000 INRMP was written. It is also needed to meet the statutory requirements of the Sikes Act (as amended), as well as the requirements of various U.S. Department of Defense and Navy Instructions.

The Revised INRMP is a long-term strategy document that would coordinate all natural resources management activities and allow for sustainable multipurpose uses of the resources. The Revised INRMP's management objectives are to integrate vegetation management, wildland fire management, fish and wildlife management, land (including surface water) management, horse and burro management, and outdoor recreation as practical and consistent with the military mission, safety requirements, and established land uses.

1.4 Decision to be Made

The decision to be made as a result of the analysis in this EA is to decide if an Environmental Impact Statement needs to be prepared. An Environmental Impact Statement would need to be prepared if it is anticipated that the Proposed Action or other alternative ultimately selected would have significant impacts on the human or natural environment. Should an Environmental Impact Statement be deemed unnecessary based on the alternative selected for implementation, this selection would be documented in a Finding of No Significant Impact.

1.5 Scope of Analysis

The Council on Environmental Quality regulations, NEPA, and Chief of Naval Operations Instruction 5090.1D specify that an EA should only carry forward detailed analysis of those resource areas potentially subject to impacts from one or more of the alternatives. This EA includes an analysis of potential environmental impacts and beneficial effects associated with the Proposed Action and a No Action Alternative. Resources carried forward for detailed analysis in this EA include biological resources, cultural resources, topography, geology and soils, and water resources.

See Table 3-1 for potential impacts on resource areas by alternative.

The following resource areas do not warrant detailed analysis in this EA. It is anticipated that there would be no effects, or only minimal effects, to these resource areas upon implementation of the alternatives.

Air Quality

NAWS-CL is located in a combination of areas designated "attainment/maintenance", nonattainment, and attainment/unclassified for the National Ambient Air Quality Standard for Particulate Matter smaller than 10 microns (PM_{10}). It is designated "attainment/ unclassified" for all other pollutants. Implementing any of the alternatives under the Revised INRMP would involve a negligible amount of ground disturbance; however, these activities would be minor and short-term in nature, and the implementation of standard dust minimization practices would serve to reduce the amount of dust generated during ground disturbing activities (e.g., regularly watering exposed soils, soil stockpiling, and soil stabilization). Implementation of the Proposed Action or the No Action Alternative would not result in any sustained increase or decrease of existing operational emissions from stationary and mobile sources. The restoration/maintenance activities would produce a small amount of air emissions from equipment and machinery, potential airborne pesticides/herbicides, and dust from ground disturbing activities and helicopter use (for horse gathers). The emissions, however, would be minor and temporary.

Implementation of any of the alternatives would also include prospective compliance with the General Conformity Rule of the Clean Air Act (Sec. 176(c)); therefore, none of the alternatives would cause or contribute to any violation of air quality standards in the region, or be likely to cause or contribute to any such violation in the future.

A Record of Non-Applicability was signed on 27 August 2013 stating that the Navy determined that the potential actions and management practices outlined in the Revised INRMP are exempt from conformity requirements of the Clean Air Act since these activities would result in no emission increase or an increase that is clearly *de minimis* (Appendix B).

Therefore, air quality is not carried forward for detailed analysis.

Airspace

The only activity of the alternatives that affects airspace would be use of helicopters for horse and/or burro removal, access to remote water resources, and large mammal surveys. The impact to airspace from the projected use of helicopters for 200 flight hours per calendar year would be minimal, due to its short-term, temporary frequency. Therefore, airspace is not carried forward for detailed analysis.

Land Use

Natural resources management activities would not create any new construction (with the exception of spring fence installation) or demolition. Activities under the alternatives include monitoring and surveying of natural resources, as well as assisting in the development of

recreational and landscaping plans. The alternatives were developed with the criteria of providing for no net loss in capability of military lands to support the military mission of the Station. In reference to the 2005 Comprehensive Land Use management Plan (or the proposed update to that plan prepared in conjunction with the land withdrawal renewal discussed in Section 1.2), the activities possible under the alternatives would not change land use designations, no other new uses are proposed, and no land use compatibility issues would occur. Implementation of either of the alternatives would have no impacts to land-use, and therefore this resource area is not carried forward for detailed analysis.

Noise

Noise impacts associated with natural resources management activities are generally negligible. A small amount of noise could come from a short-term use of mechanical equipment and motor vehicle use in restoration, maintenance, or survey work. A minimal amount of noise could come from a projected use of helicopters (200 flight hours per calendar year) to perform management activities such as horse removal, access to remote water resources, and large mammal surveys. The helicopter noise would not overlap with current noise contours from existing air operations and would not fly over homes or populated areas. Operations are concentrated in remote range areas away from the periphery of the Station. Off-Station flight activities are over remote, unpopulated areas. For these reasons, and because noise receptors on NAWS-CL would notice little difference between noise created from these actions and the much louder background noise from the existing air operations, this resource area is not carried forward for detailed analysis.

Public Health and Safety and Protection of Children

Federal agencies must “make it a high priority to identify and assess environmental health risks that may disproportionately affect children and shall ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks and safety risks” (Executive Order [EO] 13045). There is very limited public access to the facilities and properties under the control of NAWS-CL. None of the alternatives propose measures that would present health risks that affect children or the public; therefore, this resource area is not carried forward for detailed analysis.

NAWS-CL is currently assessing and remediating areas of past contamination. Hazardous materials are used in limited quantity and concentration at NAWS-CL in support of the military mission and Station personnel. All hazardous materials are handled, stored, used, disposed, and transported in accordance with applicable U.S. Environmental Protection Agency, California, and Navy regulations. Examples of hazardous materials used on the properties include lubricants, degreasers, solvents, acids, paints, pesticides, and laboratory chemicals.

The use of hazardous materials by any of the alternatives would follow all regulations and guidelines, and none of the alternatives include alterations to the hazardous materials policy and compliance. None of the alternatives would have any impacts to Installation Restoration sites.

Reducing the number of horses and burros has the potential to benefit safety on airfields and roadways and for air traffic operations. Aircraft have the potential to collide with burros on the runways, and their feces must be cleaned up immediately to avoid uptake by aircraft and the fouling of engines. While these interactions are limited and infrequent to date, allowing the Centennial Herd (Herd) to grow could increase the number of incidents.

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The effects on public health and safety would be minor; therefore, this resource area is not carried forward for detailed analysis.

Public Services

Police and fire protection services are provided by Navy personnel at NAWS-CL. Police protection is performed by the China Lake Police and Physical Security Division. Division personnel are responsible for maintaining law and order and implementing access control policies and procedures. NAWS-CL operates fire stations at Mainsite and Armitage Airfield. Additionally, assistance is available through a mutual-aid agreement with the Kern County Fire Department (structure fire only) stations in Ridgecrest and Inyokern. Wildland fire support is provided by the Bureau of Land Management, San Bernardino County, and the United States Forest Service.

Implementation of the Proposed Action or the No Action Alternative would not affect how these services are provided to the public nor would they cause significant increase/decrease for their need. Therefore, this resource area is not carried forward for detailed analysis.

Recreational Opportunities and Visual Resources

Limited and controlled recreational opportunities are available at NAWS-CL. For example, petroglyph tours are led by trained tour guides and allowed on a non-interference basis. Tours are coordinated with the Environmental Management, Safety and Security, Range, and the Public Affairs Departments. Participants are briefed on procedures and proper behavior regarding prevention of damage to petroglyphs. The public is also allowed access to the golf course at Mainsite, and a 15-stable facility (Building 01390) is available for resident horse owners. Windsailing occurs on the Mirror Lake dry lake playa. Annual chukar (*Alectoris chukar*; upland bird) hunts are coordinated with the Department of Morale, Welfare and Recreation. The Station sponsors visits by members of the local Audubon Society to the Wastewater Treatment Plant for bird-watching activities. Current recreational opportunities would not be inhibited by implementation of any of the alternatives. The Revised INRMP management objectives and proposed projects would not change public or Navy staff view sheds nor generate any sources of light or glare. The Morale, Welfare and Recreation department has a website listing current public access opportunities and events. The Proposed Action Alternative would slightly benefit recreational opportunities by contributing access opportunity and event information for the website and supporting the Morale, Welfare and Recreation's development of an outdoor recreation plan. The recreation plan would evaluate new recreational opportunities such as partnering with other groups in programs such as Watchable Wildlife.

The effects on recreational opportunities and visual resources would be minor; therefore, this resource is not carried forward for detailed analysis.

Socioeconomics and Environmental Justice

Population

The China Lake area is located within the census area of Ridgecrest, Inyokern, and China Lake Acres. Based on data from the 2010 census, the populations for these areas were reported as 27,616; 1,099; and 1,876, respectively (U.S. Census Bureau 2012).

Employment

The economy of the Indian Wells Valley/Ridgecrest region is provided primarily by the military, retail trade, government, and manufacturing sectors of the economy. According to the 2010 census, the annual median income of the county is $47,089 with 20.8% of the population in Kern county living below the poverty line. The City of Ridgecrest has 13.7% of their population below the poverty line and an annual median income of $57,693 (U.S. Census Bureau 2012).

Implementation of the alternatives would not impact socioeconomics and environmental justice. There would be no disproportionately high environmental or health impacts on low-income or minority populations from implementation of any of the alternatives. Therefore, this resource area is not carried forward for detailed analysis.

Transportation/Traffic

NAWS-CL can be accessed from U.S. Highway 395 and State Route 178, which provide access to the City of Ridgecrest and the main entrance to the South Range. The primary north-south access is by way of State Route 14 and U.S. Highway 395 to the west, which provides access to and from Ridgecrest, as well as through-traffic inter-county connections and traffic to and from the Los Angeles region. Recreation travel from southern California to mountain recreation areas heavily uses both routes. State Route 178 is routed through the cities of Ridgecrest and Inyokern, providing east-west service using city streets (Inyokern Road, China Lake Boulevard, and Ridgecrest Boulevard).

Internally, NAWS-CL is serviced by a network of roads, the majority of which are two-lane dirt roads, graded on an as-needed basis. Due to ongoing military activities, the majority of areas on the Station have controlled access and minimal traffic on those roads.

None of the alternatives would increase the amount of traffic or change transportation or traffic routes due to their implementation. There would be no impact to transportation at NAWS-CL; therefore, this resource is not carried forward for further analysis.

Utilities

Major utility systems at NAWS-CL include water, wastewater treatment, flood control, electrical service, natural gas, propane, and steam distribution. Most of the systems are at Mainsite and

adjacent areas. Facilities located on the North and South Ranges are served by a limited, local distribution network. Typically, utilities are placed adjacent to the roads on each range (Navy 2005).

Water

Groundwater supplies all of the water needs at NAWS-CL. The Station owns and operates the supply, storage, and distribution systems. Agreements with the Indian Wells Valley Water District and Inyokern Community Services District allow these districts to exchange water in emergency situations (Navy 2013a).

Deep wells in the Indian Wells Valley area are the source of potable water for the population center at the North Range (Navy 2013a). Water for fire protection is also provided by the same system.

Wastewater

The wastewater treatment plant is leased to the City of Ridgecrest, which operates and maintains the plant in order to meet water quality standards set by the Lahontan Regional Water Quality Control Board. Individual septic tanks are under the jurisdiction of the San Bernardino and Kern County health departments. The City of Ridgecrest processes wastewater from NAWS-CL and the Ridgecrest area and facilitates the primary and secondary treatment of the water.

Electricity

Southern California Edison provides electrical service to NAWS-CL from its Inyokern substation (Navy 2004). In order to distribute the electricity effectively, 33 on-Station substations are in place and working. These substations provide power to each building via above-ground power lines.

Natural Gas

Pacific Gas & Electric provides natural gas service to NAWS-CL. Natural gas is the primary fuel used for space, process, and water heating in the more populated areas. Approximately 1,000 natural gas service connections supply NAWS-CL through a gas main transmission line installed in the late 1950s (Navy 2013a).

Solid Waste

The Station has an active pollution prevention program to reduce the amount of hazardous materials purchased/generated on-Station, in accordance with Chief of Naval Operations Instruction 5090.1D "Environmental and Natural Resources Program Manual." The program aims to ensure the amount of hazardous materials purchased, are limited to what is needed, and thus reduce the amount of hazardous wastes that are disposed of.

The pollution prevention program is implemented by the Environmental Management Division. It includes requirements to develop integrated waste management procedures and to document these procedures in a Solid Waste Management Plan (Navy 2013a). The program attempts to

divert waste away from the landfill and provides benefits to the Station by lowering landfill costs and increasing the ability to recover money through the sale of recyclable materials.

None of the alternatives would significantly alter utility capabilities or their usage due to their implementation. There would be no impact to utilities at NAWS-CL; therefore, this resource is not carried forward for further analysis.

1.6 Intergovernmental Coordination

Interagency cooperation contributed to the development of the Revised INRMP, as required by the Sikes Act (as amended). Participation ensures the mutual agreement among these parties concerning conservation, protection, and management of natural resources on NAWS-CL. Representatives from the following agencies were solicited for comment on the Revised INRMP:

- U.S. Bureau of Land Management
- California Department of Fish and Wildlife
- U.S. Fish and Wildlife Service

1.7 Regulatory Compliance

This EA has been prepared pursuant to the following:

- NEPA of 1969 (42 USC 4321-4370h);
- Council of Environmental Quality regulations (40 Code of Federal Regulations 1500-1508; and,
- U.S. Department of Defense Procedures for Implementing NEPA (32 Code of Federal Regulations 75), as described in the Chief of Naval Operations Instruction 5090.1D.

The Navy has also taken the following legal authorities into account:

- Archeological Resources Protection Act of 1979, 16 USC §§ 470aa-470mm
- Clean Air Act, as amended, 2 USC §§ 7401-7671p, including the General Conformity Rule at 40 CFR 93 Subpart B
- Clean Water Act, 33 USC §§ 1251-1387
- Endangered Species Act, 16 USC §§ 1531-1544
- EO 11990–Protection of Wetlands, 24 May 1977
- EO 12148–Federal Emergency Management, 20 July 1979
- EO 12898–Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 11 February 1994

- EO 13045–Protection of Children from Environmental Health Risks and Safety Risks, 23 April 1997
- EO 13101–Greening the Government through Waste Prevention, Recycling, and Federal Acquisition, 14 September 1998
- EO 13112–Invasive Species, 03 February 1999
- EO 13123–Greening the Government through Energy Efficient Management, 03 June 1999
- EO 13148–Greening the Government through Leadership in Environmental Management, 21 April 2000
- EO 13186–Responsibility of Federal Agencies to Protect Migratory Birds, 11 January 2001
- EO 13514–Federal Leadership in Environmental, Energy and Economic Performance, 05 October 2009
- EO 11988–Floodplain Management, 24 May 1977
- Migratory Bird Treaty Act, 16 USC §§ 703-712
- National Historic Preservation Act, 16 USC §§ 470-470x-6
- Sikes Act (16 USC §§ 670a-670o, 74 Stat. 1052), as amended
- Soil and Water Resources Conservation Act (16 USC § 2001)

1.8 Public/Agency Involvement

The Navy published a Notice of Availability of the Draft EA for three consecutive days in the Daily Independent (Kern County), Inyo Register, and San Bernardino Sun. The Notice of Availability described the Proposed Action and announced that the Draft EA was available for public review at the Inyo County Library in Independence, California; the Kern County Library in Ridgecrest, California; and the Trona Library in Trona, California for 30 days. The Draft EA was also posted on the Commander, Navy Region Southwest website (http://www.piersystem.com/go/doc/4275/1821339/). No comments were received from the public. A Notice of Availability for the Final EA and Finding of No Significant Impact has been published in the Daily Independent (Kern County), Inyo Register, and San Bernardino Sun. It has also been made available at the Inyo County Library, Kern County Library, and the Trona Library. CD copies of the EA/Finding of No Significant Impact would be available to interested parties upon request by emailing peggy.shoaf@navy.mil.

2.0 Description of Proposed Action and Alternatives

The Council on Environmental Quality's *Regulations for Implementing the Procedural Provisions of the National Environmental Policy Act* establishes a number of policies for federal agencies, including "using the National Environmental Policy Act process to identify and assess the reasonable alternatives to the proposed action that will avoid or minimize negative effects of these actions on the quality of the human environment" (40 Code of Federal Regulations 1500.2 (e)). This chapter describes the Proposed Action and the No Action Alternative.

2.1 Reasonable Alternatives Screening Factors

A reasonable range of alternatives was identified by evaluating their ability to meet the following factors (Chief of Naval Operations Instruction 5090.1D), including:

- Are based on the principles of ecosystem management;
- Provide for sustainable multipurpose use of natural resources;
- Maintain compliance with relevant environmental regulations;
- Provide for public access for the use of natural resources subject to safety and military security considerations;
- Establish specific natural resources management objectives and timeframes for the Proposed Action; and,
- Provide for no net loss in the capability of military lands to support the military mission of the installation.

2.2 Description of Alternatives

2.2.1 Alternative 1 (Proposed Action): Implementation of the Revised Integrated Natural Resources Management Plan for Naval Air Weapons Station China Lake, Including the Wild Horse and Burro Management Plan

The Proposed Action includes the adoption and implementation of the Revised Integrated Natural Resources Management Plan (INRMP) for Naval Air Weapons Station China Lake (NAWS-CL). The Revised INRMP consists of goals and objectives for management of the Station's natural resources in a manner that would be compatible with the military uses of the property and consistent with the Sikes Act (as amended). Natural resources management projects contained in the INRMP address the following:

- Watershed management
- Soil conservation

- Wildland fire management
- Plant community management
- NAWS-CL Special Status Species management
- Pest management
- Outdoor recreation
- Landscaping
- Wildlife management
- Threatened and Endangered Species
- Wild horse and burro management

Ongoing and foreseeable resources management goals and objectives are addressed in the Revised INRMP and are summarized in a Project Implementation Table (Appendix A).

The Revised INRMP includes the NAWS-CL Wild Horse and Burro Management Plan (WHBMP). The goals of the WHBMP are to:

- Maintain the Centennial Horse Herd (Herd) within a range of 100 to 168 animals to allow for range recovery, and to maintain genetic variability and herd health. Allow for changes in this initial range over time based on habitat condition, vegetation utilization, animal numbers and distribution, and herd health.
- Achieve and maintain the burro population at zero.
- Keep the Herd healthy and self-sustaining by maintaining and improving rangeland condition. Remaining horses will be healthier and better able to survive stressful periods such as prolonged droughts and harsh winters when the rangeland resource is in a self-sustaining condition.
- Maintain herd genetic variability/diversity by periodically conducting genetic analysis on the horse herd and, if warranted, by the possible introduction of animals from other suitable herd areas, removal of young animals and/or by increasing the number of male horses and therefore the number of possible harems.
- Implement a proactive fertility control program through the application of contraceptives to breeding age mares or other methods.
- Increase the health and adoptability of horses by taking only young animals when extracting excess, by allowing the breeding herd to live out their lives on the range, and by carefully selecting the young animals to be retained. The younger animals are more marketable to the adopting public, and the herd genetic quality will improve through thoughtful selection of breeding herd recruitment.

- Minimize the cost of reducing and maintaining desired population levels.
- Minimize damage to water resources, riparian areas, uplands, and cultural resources through Herd reduction, and thereby facilitate and increase the rate of native plant and animal population recovery, including federally listed species.
- Provide for an enhanced habitat assessment program to monitor forage utilization and recovery) and an animal monitoring program to document herd size, health, and distribution.

The WHBMP contains four management strategies to control the increasing wild horse populations, when necessary. Depending on current conditions, including the size of the Herd, the condition of the habitat, and results of management strategy monitoring, any elements of the following four strategies could be implemented. Under all management strategies, any burros encountered could be removed from the Station. Horse herd population modeling was completed for the WHBMP using the Jenkins Model "WinEquus" for Management Strategies 2 through 4. The population model was designed to help wild horse and burro specialists evaluate the different management strategies under consideration for a given herd. For Management Strategy 1, the horse populations were calculated by hand as selective roping is incompatible with the WinEquus computer model.

Management Strategy 1 involves the annual removal of only young horses (two to three years old) and burros from NAWS-CL lands. Removal would be accomplished through selective roping from horseback, with the aid of a helicopter to direct desired horses and burros to gather crews. Individuals removed would be adopted (if possible) or housed in long-term holding facilities. It is projected that if Management Strategy 1 alone was implemented, after 11 years the Herd would grow to over 1,500 animals with the assumptions of a starting herd population of 532 horses, a 16% reproductive rate, and the removal of 40 horses per year. This population value is approximately nine times the upper limit of the AML for the horse herd at NAWS-CL.

Management Strategy 2 involves a gate-cut "gather" every two years, during which a portion of the Herd is gathered and removed to bring the wild horse population down to the lower range of the AML (100 animals). Under this strategy, unadoptable animals that are gathered and removed would be sent to long-term holding facilities or sanctuaries. Gathers would only be conducted if the Herd population exceeded 150 animals. Under certain conditions this could lead to a longer gather cycle (for example, if the Herd did not exceed 150 animals, the gather would be postponed an additional year or two). It is projected that if Management Strategy 2 alone was implemented, after 11 years the horse population on NAWS-CL would be reduced to 179 animals. This value is slightly over the AML for the horse herd at NAWS-CL.

Management Strategy 3 involves an 80% gather on a four-year cycle with fertility control. The first gather would be a comprehensive removal of wild horses to reach the lower AML, followed by selective removals of only animals younger than three years old. All mares not removed would be treated with contraceptives (22 month Porcine Zona Pellucida). Other fertility controls

such as chemical or mechanical sterilization could be used. During the first gather, a significant number of unadoptable animals would be removed and sent first to sanctuaries if space is available or if not to long-term holding facilities to bring the Herd within the AML. It is projected that if Management Strategy 3 alone was implemented, after 11 years the horse population on NAWS-CL would be reduced to 122 animals. This population value is within the AML for the horse herd at NAWS-CL.

Management Strategy 4 involves an 80% gather on a three-year cycle with selective removal and fertility control. Only wild horses less than three years old would be removed for adoption. Because of this stipulation the Herd would approach the AML much more slowly than under Management Strategies 2 and 3, and may not reach the AML for 20 years or more. All mares not removed would be treated with 22 month Porcine Zona Pellucida. It is projected that if Management Strategy 4 alone was implemented, after 11 years the horse population on NAWS China Lake would be 482 animals. This projected horse population would be approximately three times the upper limit of the AML for the horse herd at NAWS-CL.

Combination of Management Strategies 1–4

Under the WHBMP, any elements of the four Management Strategies could be used to assist in the management of wild horses and burros on the Station. Through this adaptive approach, the Herd's population would be maintained between the upper and lower limits of the AML (168-100 individuals).

2.2.2 No Action Alternative: Retain 2000 Integrated Natural Resources Management Plan and Current Horse and Burro Management Strategies

The No Action Alternative involves the continued implementation of the 2000 INRMP for NAWS-CL. The natural resources on-Station would continue to be managed per the goals, objectives, and management practices detailed in the 2000 INRMP. Proposed new resources management goals, objectives, and strategies (discussed above and provided in Appendix A of this Environmental Assessment) would not be implemented.

Current wild horse and burro management practices on NAWS-CL would continue. The Navy notes that, due to funding constraints and other reasons, it has not been able to fully and consistently implement the horse and burro management-related components of the 2000 INRMP and other such management strategies subsequent to 2000. However, the Navy would continue to program for wild horse and burro management practices with the intent to fully implement these practices going forward. The 2000 INRMP, in accordance with the 1980 California Desert Conservation Area Resource Management Plan, would aim to maintain a herd size of 168 horses by:

- Continuing annual roundups.

- Annually assessing herd size, herd condition, and distribution of sub-herds.

• Continuing to work closely with the Bureau of Land Management during roundups and throughout the year.

Currently, horse and burro gathers can be conducted on an annual basis per a 2010 Memorandum of Agreement with the U.S. Bureau of Land Management. Each year, consideration would be given for taking horses and burros to U.S. Bureau of Land Management facilities to be prepared for adoption. All burros encountered would be removed with the goal to achieve a population of zero burros on NAWS-CL. Removal of horses would be limited to gathering of young, readily adoptable horses (less than three years of age). Removals would be accomplished by selective roping from horseback with aid of a helicopter to drive horses to gather crews, by run trapping, or by water trapping.

3.0 Existing Conditions and Environmental Consequences

This chapter describes the current state of resource areas on Naval Air Weapons Station China Lake (NAWS-CL) and the potential effects each alternative would have on the environment. In analyzing the environmental consequences of the Proposed Action and No-Action Alternative, several factors are considered for each resource, including: type of impact, location and footprint, duration of impact, timing (seasonality, for example), and intensity (frequency and severity).

The type of impact describes a relative measure of beneficial or adverse effects on biological or physical systems, cultural resources, or on the social environment. For example, an adverse impact type might be one that degrades the size, integrity, or connectivity of a specific habitat. Conversely, a beneficial impact type would reduce a threat or enhance an ecosystem process, native species richness, or native habitat quantity or quality. Effects of natural resources management (or its absence) are likely to occur within multiple time scales as well. For example, on a population scale, the benefits from a change in habitat condition may take a short time for some species and decades for others. Measures of intensity consider whether an effect would be negligible, minor, moderate, or major.

The vast majority of NAWS-CL property remains undeveloped and undisturbed by military/human activity. This extensive amount of land provides open habitat and supports a diverse floral and faunal assemblage.

Table 3-1 describes potential impacts on resource areas by alternative.

3.1 Biological Resources

The NAWS-CL landscape encompasses portions of two floristic provinces: the Mojave Desert (represented by the entire South Range and portions of North Range), and the Great Basin (northern portions of the North Range; Map 3-1). While dominated by Mojave Desert flora, portions of the North Range also show affinities with Sierra Nevada and White-Inyo Range flora. These subregions vary in temperature extremes and the seasonality of precipitation (Baldwin and Martens 2002; Thomas et al. 2004).

NAWS-CL has diverse flora and fauna. This is due in part to the two floristic provinces (the Mojave Desert and the Great Basin), but also to the unique water features (natural waters such as seeps and springs, as well as the Waste Water Treatment Facility, evaporation ponds, and the Lark Seep System), large elevation range (1,660 to 8,839 feet), and the intact nature of the property.

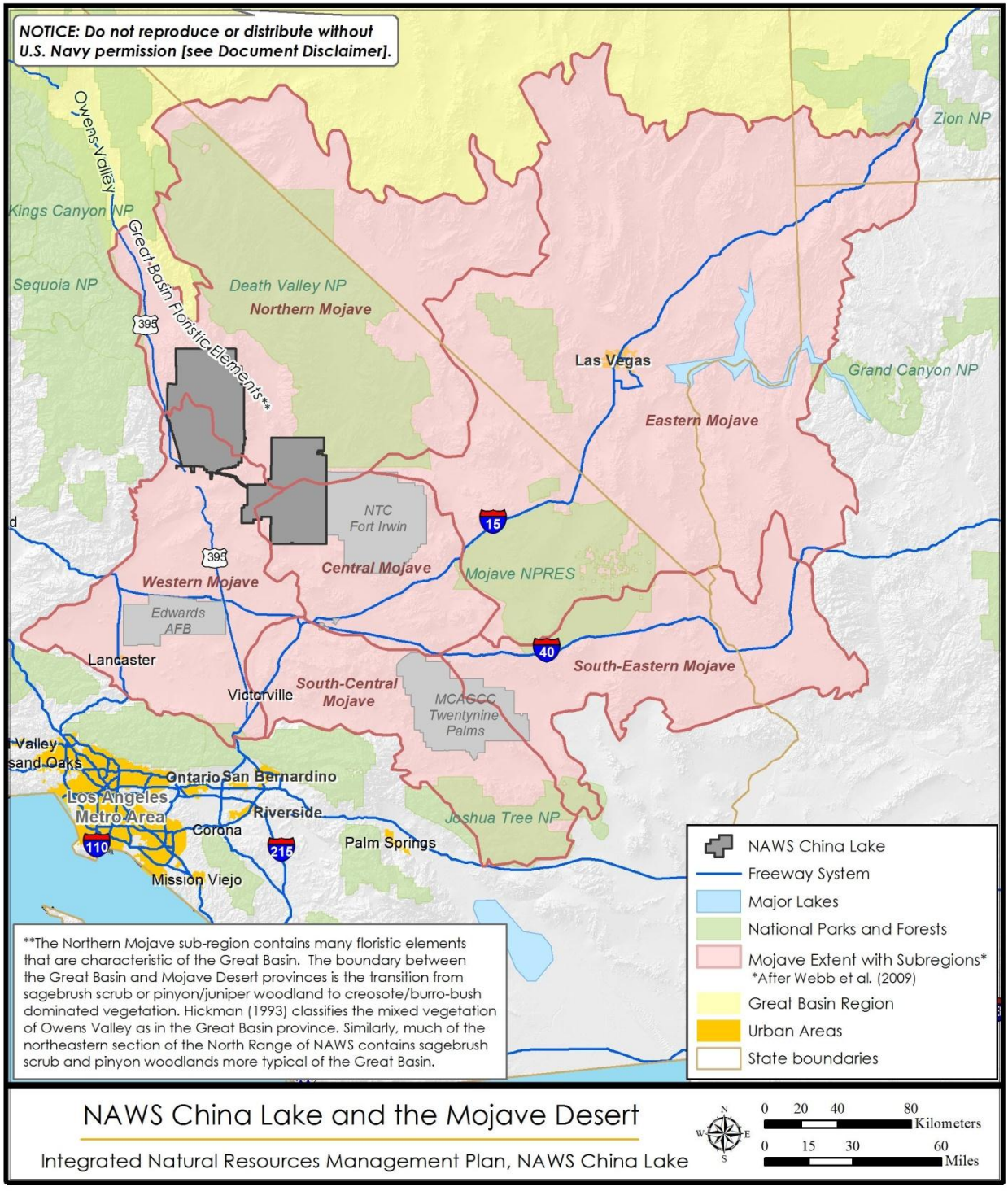
For the purposes of this Environmental Assessment, the biological resources section is broken down into four sections: vegetation communities, wildlife populations (includes five subsections for invertebrates, fishes, reptiles and amphibians, birds, and mammals), special status plant species, and special status wildlife species.

Table 3-1. Summary of potential environmental effects by alternative.

Resource Area	Proposed Action: Alternative 1 Revised INRMP including the WHBMP	No Action Alternative: Retain the 2000 INRMP and Current Horse and Burro Management Strategies
Biological Resources	The Revised INRMP would have moderate benefits for vegetation communities, wildlife populations, and special status plant and wildlife species through the implementation of enhanced monitoring and surveying of biological resources. Restoration and maintenance of native habitats would aid in the recovery of listed species and the continued functioning of ecosystems. The protection of water resources through the continued installation and maintenance of fencing around springs and the removal of invasive species would have substantial beneficial effects on biological resources. Long-term benefits to all biological resources through the maintenance of an appropriate management level for wild horses and burros. A reduction in horse and burro populations would reduce grazing pressure, forage competition, impacts from trampling and water resource degradation. The WHBMP would benefit the Centennial Horse Herd (Herd) by increasing its resiliency in the face of environmental extremes, increasing the sustainability of the Herd and by maintaining genetic diversity. No Significant Impact	The continuation of management practices under the existing INRMP would have moderate benefits for vegetation communities, wildlife populations and special status plant and wildlife species through the implementation of enhanced monitoring and surveying of biological resources. Restoration and maintenance of native habitats would aid in the recovery of listed species and the continued functioning of ecosystems. The protection of water resources through the continued installation and maintenance of fencing around springs and the removal of invasive species would have moderate beneficial effects on biological resources. Benefits to biological resources would result through coordinated efforts with the BLM to reach and maintain the designated numbers for horse and burro populations using Current Horse and Burro Management Strategies. No Significant Impact
Water Resources	Would benefit through the continued exclusion of wild horses and burros from selected water resources. Would also receive benefits through the utilization of restorative and preventative management techniques for springs, seeps and floodplains. The maintenance of an appropriate management level for the wild horse populations and burro populations would reduce impacts to water resources in the long-term. No Significant Impact	Would benefit from the continued exclusion of wild horses and burros from selected water resources. Benefits to water resources would result through coordinated efforts with the BLM to reach and maintain the designated numbers for horse and burro populations using Current Horse and Burro Management Strategies. No Significant Impact

Table 3-1. Summary of potential environmental effects by alternative.

Resource Area	Proposed Action: Alternative 1 Revised INRMP including the WHBMP	No Action Alternative: Retain the 2000 INRMP and Current Horse and Burro Management Strategies
Topography, Geology, and Soils	Under the Revised INRMP, would receive minimal benefits through the utilization of Best Management Practices that prevent erosion, support soil stability and support geologic function of ecosystems. With the implementation of the WHBMP, there would be a reduction in the number of wild horses and burros. Soil erosion and compaction would be reduced as wild horses and burros are kept at the appropriate management level. Native soil and geologic function would benefit as the impact from the movement of hooved animals was reduced. No Significant Impact	Under the existing INRMP, would receive minimal benefits through the utilization of Best Management Practices that prevent erosion, support soil stability and support geologic function of ecosystems Benefits to soil resources would result through coordinated efforts with the BLM to reach and maintain the designated numbers for horse and burro populations using Current Horse and Burro Management Strategies. No Significant Impact
Cultural Resources	Would continue to benefit from the implementation of the consulting process currently in place at NAWS-CL. To the maximum extent possible cultural resources would continue to be avoided. The implementation of the WHBMP would reduce impacts to cultural resources at NAWS-CL. The reduction in the Herd's numbers would reduce the intensity to which horses impact previously damaged areas. No Significant Impact	Would continue to benefit from the implementation of the consulting process currently in place at NAWS-CL. To the maximum extent possible cultural resources would continue to be avoided. Cultural resources present impacts would be reduced through coordinated efforts with the BLM to reach and maintain the designated numbers for horse and burro populations using Current Horse and Burro Management Strategies. No Significant Impact



Map 3-1. Subregion boundaries within the Mojave Desert including national park and military reserve boundaries. The subregion boundaries are based on Bailey (1995) and Wiken (1986).

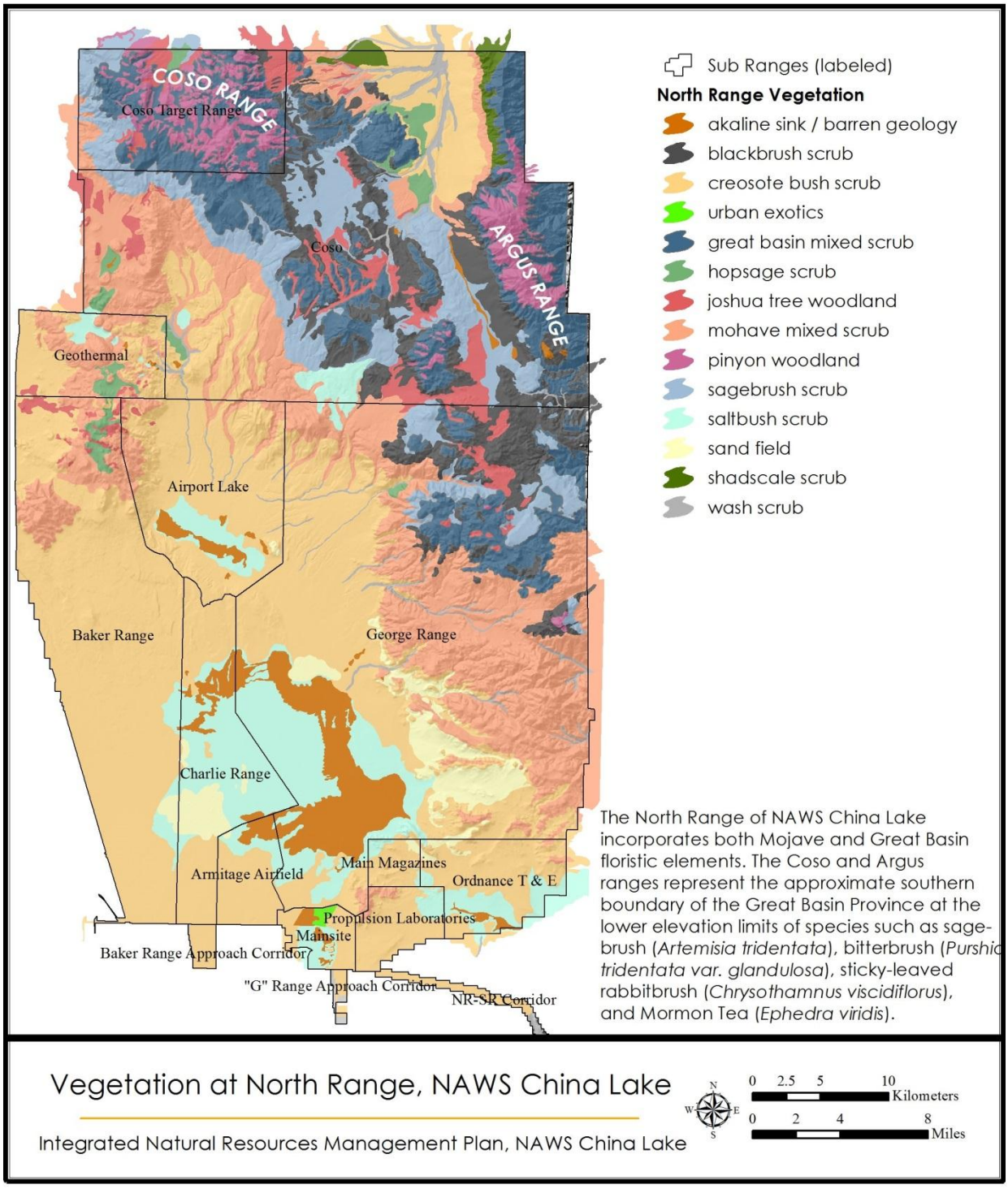
3.1.1 Vegetation Communities

There are 19 different vegetation communities classified at NAWS-CL, of which 17 are mapped (U.S. Department of the Navy [Navy] 2005). The communities identified are: Pinyon Woodland, Great Basin Mixed Scrub, Sagebrush Scrub, Blackbrush Scrub, Joshua Tree Woodland, Desert Transition Scrub, Mojave Mixed Scrub, Unique Zones of Mojave Mixed Scrub, Shadscale Scrub, Hop-Sage Scrub, Mojave Wash Scrub, Creosote Bush Scrub, Mojave Sand Field, Desert Holly Scrub, Saltbush Scrub, Alkaline Sink Scrub, Vernal Playa, Riparian and Disturbed/Successional. Not mapped in the NAWS-CL Geographic Information System are: Desert Transition Scrub and Disclimax (also referred to as Disturbed/Successional) (see Map 3-2 and Map 3-3 for a depiction of vegetation communities for the North and South Ranges, respectively).

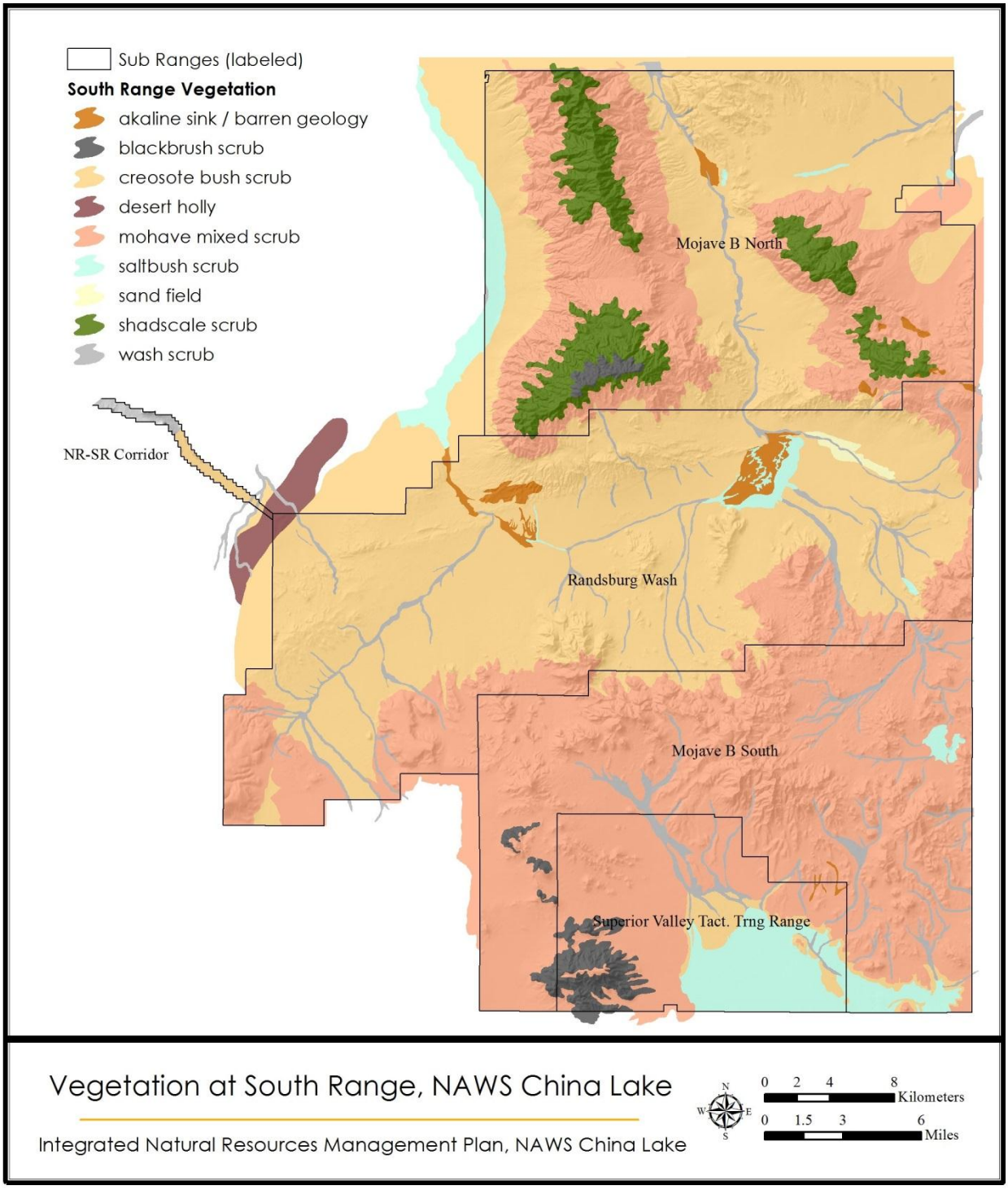
The classification system used for the mapping purposes was developed internally for NAWS-CL and is cross-referenced in the following published classification systems in Appendix L of the Revised Integrated Natural Resources Management Plan (INRMP): Brown 1982; Holland 1986; Munz and Keck 1968; Sawyer and Keeler-Wolf 1995; Rowlands 1995; Beatley 1976; NatureServe 2003; and Charlton 2003.

3.1.1.1 Wildland Fire Management

Fires are a serious threat to natural communities, as well as habitats of listed and sensitive species on NAWS-CL. Lightning and military testing and training operations have caused fires on the North Range and occasional fires adjacent to the various target areas in Superior Valley. Wildfires on the North Range have been relatively less frequent as compared to the South Range (21 total fires in 15 years), but they have resulted in large fire footprints. These fires have occurred within the same general area and were caused by unpredictable aircraft crashes or test article impacts. South Range wildfires occurred primarily in Superior Valley and have been far more frequent (209 fires in 15 years), but were much smaller in the acreage affected. These wildfires averaged about 73 acres per year with a maximum recorded burn of 450 acres. NAWS-CL is particularly concerned about fires occurring in the Superior Valley area because of the potential effects of wildfires on Mohave Desert Tortoises (*Gopherus agassizii*) and designated Critical Habitat. The potential effects of wildfires include direct mortality to individual Mohave Desert Tortoises and, in the longer term, type conversion of the plant community composition. This effect reduces the area's carrying capacity by allowing the establishment of non-native grasses that can out-compete the existing native vegetation needed for food by the Mohave Desert Tortoise. An additional concern is that these invasive species grow rapidly during years of sufficient rainfall and produce large amounts of biomass. The added biomass provides a supplemental fuel source, allowing fires to spread more rapidly and burn with increased intensity. Wildfires at NAWS-CL burned approximately 450 acres of Mohave Desert Tortoise Critical Habitat in 2011. Since 1998, a total of 209 fires have consumed approximately 1,090 acres of Mohave Desert Tortoise Critical Habitat in the Superior Valley bombing range.



Map 3-2. North Range vegetation communities at Naval Air Weapons Station China Lake.



Map 3-3. South Range vegetation communities at Naval Air Weapons Station China Lake.

Fire management strategies are outlined in the Fire Management Plan (FMP) created by FedFire, the China Lake Fire Department, in 2007 (Navy 2013c). This plan has been updated annually since its creation. The FMP did not formally address natural resources and their protection; however, it did contain a fire management strategy which, when implemented, would reduce the potential for fire impacts to the natural resources at NAWS-CL. These measures include the following:

- Maintaining previously cleared target areas (cleared unexploded explosive ordnance and vegetation) in Superior Valley to reduce the potential for fuel buildup and thereby reduce the potential for fires to catch and spread into adjoining Critical Habitat areas. To the extent possible, move target objects from the periphery into the target area center;
- Continuing to maintain the existing mutual aid fire-fighting agreements with supporting agencies, and continuing to pursue the establishment of new mutual aid agreements;
- Reviewing standard procedures for initial response and fire suppression in Superior Valley test and training operations; and,
- Using existing roads, cleared target areas, and washes as part of a fire break system.

The current fire management strategy has been revised to include the adaptive fire management measures set forth in the February 2013 Biological Opinion (BO) 8-8-12-F-29. These measures are intended to minimize and avoid fire effects to Mohave Desert Tortoise and its associated habitat, and to maintain the safety of fire management personnel involved in the containment and suppression of wildfires. The BO's fire management strategy for NAWS-CL can be found in the Appendices section of the Revised INRMP.

3.1.1.2 Invasive Plants

Non-native plants are well established throughout the Mojave Desert. Several species are known to occur at NAWS-CL (Table 3-2). Tamarisk species (*Tamarix ramosissima*, *T. chinensis*, or *T. gallica*) have invaded water sources across the Station and pose a threat to the habitat of the Inyo California towhee. A *Do Not Plant List* is attached to the Revised INRMP as an appendix to eliminate self-introduced invasive plants at NAWS-CL.

Table 3-2 California Invasive Plant Council invasive plant species known to occur at Naval Air Weapons Station China Lake (adapted from California Invasive Plant Council Inventory).

Scientific Name	Common Name	Overall Rating	Ecological Impacts	Invasiveness
Agrostis stolonifera	creeping bentgrass	Limited	Limited	Moderate
Bromus madritensis subsp. *rubens*	red brome	High	Severe	Moderate
Bromus tectorum	Cheatgrass	High	Severe	Severe

Scientific Name	Common Name	Overall Rating	Ecological Impacts	Invasiveness
Centaurea solstitialis	yellow star thistle	High	Severe	Moderate
Cynodon dactylon	bermudagrass	Moderate	Moderate	Moderate
Descurainia sophia	flixweed, tansy mustard	Limited	Limited	Moderate
Erodium cicutarium	redstem filaree	Limited	Limited	Limited
Lupinus arboreus	yellow bush lupine	Native	Moderate	Moderate
Peganum harmala	African rue	Not Listed	Not Listed	Not Listed
Phragmites australis	common reed	Native	Moderate	Moderate
Salsola paulsenii	barbwire Russian-thistle	Limited	Limited	Limited
Tamarix aphylla	athel tamarisk	Limited	Limited	Moderate
Tamarix parviflora	smallflower tamarisk	High	Severe	Severe
Tamarix ramosissima	saltcedar, tamarisk	High	Severe	Severe

California Invasive Plant Council Rating System (refers to designation for "Overall Rating"):

High: severe ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal and establishment. Most are widely distributed ecologically.

Moderate: substantial and apparent, but generally not severe-ecological impacts on physical processes, plant and animal communities, and vegetation structure. Their reproductive biology and other attributes are conducive to moderate to high rates of dispersal, though establishment is generally dependent upon ecological disturbance. Ecological amplitude and distribution may range from limited to widespread.

Limited: invasive but their ecological impacts are minor on a statewide level or there was not enough information to justify a higher score. Their reproductive biology and other attributes result in low to moderate rates of invasiveness. Ecological amplitude and distribution are generally limited, but these species may be locally persistent and problematic.

3.1.1.3 Effects on Vegetation Communities

A summary of projects and objectives for each of the alternatives that would potentially affect vegetation communities at NAWS-CL is provided below (Table 3-3).

3.1.1.3.1 Alternative 1

Revised Integrated Natural Resources Management Plan Implementation

The primary objective of Alternative 1 with respect to vegetation communities management is to improve the classification of the vegetation types at the Station and utilize this data to monitor the condition and trend of the land (including climate, weather, soil, type and amount of plant cover and disturbance). Due to the vast size of the Station, an emphasis would be placed on the use of remote sensing technologies and Geographical Information System (GIS) as much as possible to maximize the efficiency of the field effort.

Table 3-3 Summary of projects and objectives intended for vegetation communities at Naval Air Weapons Station China Lake set forth by the alternatives.

Resource Area	Proposed Action: Alternative 1 Revised INRMP including the WHBMP	No Action Alternative: Retain the 2000 INRMP and Current Horse and Burro Management Strategies
Vegetation Communities	Improve the classification of vegetation types over time, based on standards adopted by the Federal Geographic Data Committee and used by the Mojave Desert Ecosystem Program (Thomas et al. 2004), and already implemented in 1996-1997 at NAWS-CL (Silverman 1997). To avoid impacts to threatened, endangered, or NAWS-CL Special Status species, their habitats would be mapped, and mitigation measures (developed per project or used in existing BOs) would be carried out to the extent practicable. Develop a long-term program for riparian, wetland, seep, and spring protection, restoration, and enhancement. Reduce horse and burro numbers as necessary in order to avoid or minimize detrimental effects on riparian and other sensitive habitats for wildlife. Consistent with the California Desert Protection Act, support restoration of unusual plant assemblages, including areas classified as wetland riparian. Continue to work with Station and regional fire officials to identify high-value resource areas, assess fire danger, track fire patterns, and assist with maintenance of mutual support agreements. Assess burn area recovery and the need for rehabilitation in these areas. Assist with the development and implementation of a wildland fire plan. Implement all measures prescribed by fire management strategies and 2013 Desert Tortoise BO.	Continue to inventory and document vegetation resources at NAWS-CL. Continue to implement management strategies outlined in 2007 FMP. Implement all measures prescribed in the 2013 BO.
Invasive Plant Species	Continue to monitor for invasive species, and document status and new occurrences. Continue control efforts and monitor effectiveness or removal efforts. Assess the need to update the Weed Management Plan based on identified management issues.	Continue to monitor for invasive species, and document status and new occurrences. Continue control efforts and monitor effectiveness or removal efforts.

Areas of habitat for NAWS-CL Special Status Species would be mapped. Identifying these areas and determining habitat value for special status species would help in the management and recovery of special status species. Riparian, spring, seep, and wetland habitats are especially important for the maintenance of associated desert wildlife and recovery of endangered desert species (Inyo California Towhee and Mohave tui chub). Under Alternative 1, riparian, spring, seep, and wetland habitats would be protected and enhanced. A thorough delineation of all water resources would allow for proper management actions to be taken. Additionally, the continued removal of horses and burros, establishment of fencing around springs/seeps, and continued floral invasive species (*Tamarix* spp.) control in springs, riparian areas and adjacent uplands would aid in the restoration and maintenance of these highly valuable resources.

The implementation of Alternative 1 would also help to reduce the chance of impacts to vegetation communities from wildland fires. Wildland fires increase habitat type conversion and the presence of invasive species, both of which irreparably damage native vegetation communities. Alternative 1 would implement the prescribed fire management strategies and the 2013 Mohave Desert Tortoise BO. Both the BO and the management strategies emphasize continuing mutual aid agreements, maintaining/minimizing fuel loads around test/target sites, controlling invasive species, and evaluating the effectiveness of fire management strategies on a regular basis. These strategies, if implemented would lower the risk of fire damage to the vegetation communities and limit the impact fires do have once started by reducing their ability to spread.

Regular monitoring practices and the enforcement of control measures at construction sites and routine ground disturbance sites would reduce the spread of non-native species. An ecologically-based pest management plan would be implemented so as to prioritize target species/locations. Work with regional partners would occur to manage invasions that initiate from outside the property boundaries of NAWS-CL

Through more thorough vegetation mapping, the implementation of protective and restorative actions for valuable vegetation communities, a reduction in non-native species and a reduction of the impacts from wildland fires, Alternative 1 would have moderate beneficial impacts on all plant communities at NAWS-CL.

Wild Horse and Burro Management Plan Implementation

The Centennial Herd (Herd) population is now 450-500 individuals (T. Campbell, pers. com. 2013), which is approximately three times the upper limit of the appropriate management level (AML). Direct impacts associated with wild horse and burro gathers would consist of minor, temporary disturbance to vegetation immediately in and around the gather site(s) and holding facilities. Human impacts would be created by temporary foot traffic at gather sites and holding facilities that would disturb vegetation. Wild horse impacts as a result of herding concentrations could be moderate in the immediate vicinity of the gather site(s) and holding facilities. Generally, these sites would be small (less than one-half acre) in size. Any impacts would remain site specific and isolated in nature and would include trampling of vegetation. Long-term impacts would be

minimal as herding would have a short-term duration as vegetation would recover within a few years depending upon rainfall and degree of trampling.

In addition, most gather sites and temporary corrals would be selected to enable easy access by transportation vehicles and logistical support equipment. Normally, these sites are located near or on roads, pullouts, or other flat areas, which have been previously disturbed. These common practices would minimize the short-and long-term effects of these impacts to vegetation.

Indirect impacts of implementing Alternative 1 would be realized through a reduction of current horse populations, thereby providing the opportunity for impacted vegetation communities to achieve increased resiliency to environmental disturbance and improved ecological function. Competition for forage among wild horses, burros, and wildlife would be reduced as utilization levels decrease, allowing for the recovery of healthier vegetation communities.

There would be moderate beneficial impacts to vegetation communities at NAWS-CL from implementation of the Wild Horse and Burro Management Plan (WHBMP) under Alternative 1.

Therefore, there would be no significant impacts to vegetation communities at NAWS-CL from implementation of the Revised INRMP including the WHBMP under Alternative 1.

3.1.1.3.2 No Action Alternative

Retain the 2000 Integrated Natural Resources Management Plan

The 2000 INRMP addresses vegetation management through affiliated management strategies: habitat conservation measures, fire management, re-vegetation activities, exotic plant control, and landscaping practices. Efficient land use practices based on 2000 INRMP recommendations would be used, including:

- Inventory, document, and verify knowledge of vegetation resources on NAWS-CL;
- Recognize special status plants during land use planning, surface development, and field surveys;
- Maintain habitat quality in areas not developed or used for Naval Research, Development, Acquisition, Test and Evaluation activities; and,
- Minimize negative seasonal effects by scheduling activities with higher potential to impact resources (ground-breaking construction, tree-trimming, etc.) from late-summer through early-winter. The timing of this work would aid in avoiding impacts during the breeding season for most species.

Fire management strategies would be the same under the No Action Alternative as described for Alternative 1 because NAWS-CL has already implemented the updated fire management strategies set forth in the 2013 BO. These strategies emphasize continuing mutual aid agreements, maintaining/minimizing fuel loads around test/target sites, controlling invasive species, and

evaluating the effectiveness of fire management strategies on a regular basis. These strategies, if implemented, would lower the risk of fire damage to the vegetation communities and limit the impact fires do have once started by reducing their ability to spread.

The No Action Alternative would continue the removal of high priority species (i.e., tamarisk) and monitor and evaluate the necessity for removal of other species. Additionally, the 2000 INRMP calls for the continuation of identification and mapping of invasive sites.

The 2000 INRMP would also require NAWS-CL to ensure compliance with all applicable regulations governing removal of invasive species. The implementation of the No Action Alternative would reduce the impacts of invasive species on native species and habitats.

There would be moderate beneficial impacts to vegetation communities at NAWS-CL from implementation of the No Action Alternative.

Current Horse and Burro Management Strategies Implementation

The effects to vegetation from the wild horse and burro management portion of the No-Action Alternative (2000 INRMP) would generally be the same as described for Alternative 1 (Revised INRMP). This is because the 2000 INRMP and the Revised INRMP both have the objective of achieving and maintaining the Centennial Horse Herd to fewer than 168 animals, which is the AML identified in the California Desert Conservation Area Plan. The AML is considered to be the number of horses that NAWS-CL lands can successfully sustain without long term impacts to its natural resources. Both the 2000 INRMP and the Revised INRMP include horse roundups as a management strategy to reduce the numbers of horses, and the only difference between the INRMP versions is that in addition to roundups, the Revised INRMP also provides for the use of other management strategies to reach the AML. Both INRMP versions contain the objective of achieving and maintaining a wild burro population of zero on NAWS C-CL. Therefore, implementation of the No-Action Alternative would not result in significant impacts to vegetation.

3.1.2 Wildlife Populations

3.1.2.1 Invertebrates

To date, 1,953 species of insects and spiders (38) have been collected at NAWS-CL (list updated as of 2010 with unpublished data from Gordon Pratt). While entomologists routinely record previously unknown species on NAWS-CL (G. Pratt, pers. com. 1996), many species of invertebrates remain undiscovered due to their secretive nature and long periods of inactivity, particularly during dry years. It is possible that NAWS-CL hosts as many as 10,000 species of invertebrates (Pratt, letter dated 06 December 1996). The insect species collected thus far encompass 16 Orders and 234 Families (Table 3-4). Among the most studied families, the greatest diversity has been found in the Order Lepidoptera (441 species, 28 Families), followed by the Order Diptera (414 species, 55 Families) and the Order Hymenoptera (362 species, 37 Families).

Table 3-4 Summary of invertebrate species known from Naval Air Weapons Station China Lake (list updated with data from G. Pratt, 2010 unpubl. data).

Order	# Families	# Species
Araneae (Spiders)	17	38
Archaeognatha (Bristletails)	1	1
Blattodea (Cockroaches)	1	3
Coleoptera (Beetles)	38	263
Diptera (Flies)	55	414
Embiidina (Webspinners)	1	1
Hemiptera (True bugs)	24	113
Homoptera (Aphids, Hoppers & Cicadas)	15	92
Hymenoptera (Ants, Wasps & Bees)	37	362
Isoptera (Termites)	1	1
Lepidoptera (Moths & Butterflies)	28	441
Mantodea (Mantids)	1	2
Neuroptera (Net-winged insects)	8	54
Odonata (Damselflies & Dragonflies)	5	35
Orthoptera (Crickets & Grasshoppers)	7	34
Trichoptera (Caddisflies)	4	5
TOTALS	**234**	**1833**

3.1.2.2 Fishes

More than 120 springs, two seeps, approximately 20 constructed ponds, and a large number of tanks and troughs are present on NAWS-CL. These areas provide habitat for five species of fish on station. All of these species—Mohave tui chub (*Siphateles bicolor* subsp. *mohavensis*), mosquito fish (*Gambusia affinis*), bullhead catfish (*Ictalurus* sp.), goldfish (*Carassius auratus*), and largemouth bass (*Mieropterus salmoides*)—are introduced, non-native species. The Mohave tui chub, mosquito fish, goldfish, and bullhead catfish are known to exist in the Lark Seep System, located on the south-central portion of the North Range. Goldfish are present in the North Channel of the Lark Seep System and in constructed ponds at the Station. Largemouth bass occur in ponds at Area R on the North Range (Navy 1998, 2004).

3.1.2.3 Reptiles and Amphibians

36 species of reptiles and amphibians are known to occur at NAWS-CL. Reptiles, well adapted to the heat and aridity prevalent at NAWS-CL, are more abundant and diverse than amphibians. The few amphibians that occur at NAWS-CL include: the Western Toad (*Anaxyrus boreas*), Pacific Treefrog (*Pseudacris regilla*), and American Bullfrog (*Lithobates catesbeianus*). Slender Salamanders (*Batrachoseps* sp.), though not yet recorded at NAWS-CL, are present in all of the surrounding ranges (Panamint, Inyo, and Sierra Nevada) and have the potential to occur on-Station. Snakes and lizards make up the majority of the herptofauna at the Station. Common lizard species include: Zebra-tailed Lizard (*Callisaurus draconoides*), Common Side-blotched Lizard (*Uta stansburiana*), Desert Spiny Lizard (*Sceloporus magister*), and Tiger Whiptail (*Aspidoscelis tigris*). Common snake species found throughout NAWS-CL include: the

Coachwhip (*Coluber flagellum*), Great Basin Gopher Snake (*Pituophis catenifer deserticola*), Western Patch-nosed Snake (*Salvadora hexalepis*), Western Shovel-nosed Snake (*Chionactis occipitalis*), and three rattlesnake species: the Sidewinder (*Crotalus cerastes*), Mohave Rattlesnake (*Crotalus scutulatus*), and Speckled Rattlesnake (*Crotalus mitchellii*). The Mohave Desert Tortoise is discussed under Section 3.1.4 Special Status Wildlife Species.

3.1.2.4 Birds

The vast size of the Station, myriad of topographic features, and high plant diversity make it preferred habitat for a large number of bird species. Over 322 bird species are either migrant or resident species at NAWS-CL. A complete list of avian species observed at NAWS-CL can be found in Appendix I of the Revised INRMP (Navy 2013a). Birds and their associated habitats can be found in Table 3-5.

Many avian species recorded at NAWS-CL are neotropical migrants that use the ranges during migration or for breeding and leave North America during the winter months. Open water, such as Lark Seep, the wastewater treatment plant, and Airport and China Lakes (in wet years) provide foraging and resting habitat for migrating birds as well as wintering habitat for a variety of waterfowl. NAWS-CL participates annually in the Audubon Christmas Bird Counts, which help to augment this list.

3.1.2.4.1 Bird/Wildlife Aircraft Strike Hazard Prevention

The objective of the Bird/Wildlife Aircraft Strike Hazard (BASH) Prevention program is to reduce the potential of collisions between aircraft and wildlife, thus minimizing damage and injuries due to collisions. No single solution exists to the BASH problem; a variety of techniques and organizations must be involved to ensure success of this program.

Birds, coyotes, and other animals pose strike hazards to aircraft on the airfield. Aircraft strikes can cause serious and costly damage to aircraft and can result in injury or fatalities to personnel. Armitage Airfield lacks habitats and features that attract large numbers of birds. NAWS-CL maintains a U.S. Fish and Wildlife Service (USFWS) depredation permit for nuisance birds at the airfield and renews the permit every April.

Table 3-5 Birds and their associated habitats on Naval Air Weapons Station China Lake. Habitat categories are modified from California Wildlife Habitat Relationships System.

Habitat	Resident or Migrant, Expected Breeding	Migrants Only

Table 3-5 Birds and their associated habitats on Naval Air Weapons Station China Lake. Habitat categories are modified from California Wildlife Habitat Relationships System.

Habitat	Resident or Migrant, Expected Breeding	Migrants Only
Riparian Woodland	lesser goldfinch (*Carduelis psaltria*), blue-gray gnatcatcher (*Polioptila caerulea*), ash-throated flycatcher (*Myiarchus cinerascens*), Inyo California towhee (*Pipilo crissalis eremophilus*), spotted towhee (*Pipilo maculatus*), verdin (*Auriparus flaviceps*), black-throated sparrow (*Amphispiza bilineata*), Bewick's wren (*Thryomanes bewickii*), and Costa's hummingbird (*Calypte costae*)	Wilson's warbler (*Wilsonia pusilla*), yellow-rumped warbler (*Dendroica coronata*), warbling vireo *(Vireo gilvus*), western tanager (*Piranga ludoviciana*), Cassin's vireo (*Vireo cassinii*), dark-eyed junco (*Junco hyemalis*), white-crowned sparrow (*Zonotrichia leucophrys*), orange-crowned warbler (*Vermivora celata*), Pacific-slope flycatcher (*Empidonax difficilis*)
Pinyon	pinyon jay (*Gymnorhinus cyanocephalus*), spotted towhee, chipping sparrow (*Spizella passerina*), black-throated gray warbler (*Dendroica nigrescens*), dark-eyed junco, blue-gray gnatcatcher, dusky flycatcher (*Empidonax oberholseri*), bushtit (*Psaltriparus minimus*)	northern flicker (*Colaptes auratus*), red-breasted nuthatch (*Sitta canadensis*), yellow-rumped warbler, orange-crowned warbler, Wilson's warbler
Joshua Tree Woodland	cactus wren (*Campylorhynchus brunneicapillus*), Bewick's wren, Scott's oriole (*Icterus parisorum*), Say's phoebe (Sayornis saya), ash-throated flycatcher, loggerhead shrike (*Lanius ludovicianus*), ladder-backed woodpecker (*Picoides scalaris*)	white-crowned sparrow, chipping sparrow, western tanager, Wilson's warbler
Sagebrush	sage sparrow (*Amphispiza belli*), Say's phoebe, horned lark (*Eremophila alpestris*), and loggerhead shrike	sage thrasher (*Oreoscoptes montanus*), and white-crowned sparrow
Creosote Bush Scrub	sage sparrow, black-throated sparrow, Say's phoebe, LeConte's thrasher (*Toxostoma lecontei*), loggerhead shrike, and greater roadrunner (*Geococcyx californianus*)	Wilson's warbler, western tanager, yellow-rumped warbler, and warbling vireo
Desert Wash	LeConte's thrasher, black-throated sparrow, loggerhead shrike, greater roadrunner, and northern mockingbird (*Mimus polyglottos*)	
Manmade Habitats (Golf Course, Urban, Sewer Ponds)	killdeer (*Charadrius vociferus*), mourning dove (*Zenaida macroura*), great-tailed grackle (*Quiscalus mexicanus*), red-winged blackbird (*Agelaius phoeniceus*), gadwall (*Anas strepera*), cinnamon teal (*Anas cyanoptera*), American avocet (*Recurvirostra americana*), common yellowthroat (*Geothlypis trichas*), Virginia rail (*Rallus limicola*)	Over 250 species have been documented at the golf course, Mainsite, and waste treatment plant.

3.1.2.5 Mammals

NAWS-CL ranges support more than 80 mammal species (See Appendix I of the Revised INRMP [Navy 2013a]). There are no federally-listed threatened or endangered mammal species that occur at NAWS-CL, and only a single state protected species, the Mohave ground squirrel (*Xerospermophilus mohavensis*), has been recorded. The desert cottontail (*Sylvilagus audubonii*), black-tailed jackrabbit (*Lepus californicus*), and white-tailed antelope squirrel (*Ammospermophilus lecurus*) are widespread throughout the Mojave Desert and at NAWS-CL. Other species supported by pinyon pine include Panamint chipmunk (*Neotamias panamintinus*), pinyon mouse (*Peromyscus truei*), dusky-footed woodrat (*Neotoma fuscipes*), common porcupine (*Erethizon dorsatum*), and striped skunk (*Mephitis mephitis*) (Navy 1989b, 1998, 2004). Seventeen species of bats are found at NAWS-CL and several of these are California

Species of Special Concern: western mastiff bat (*Eumops perotis),* pallid bat *(Antrozous pallidus*), Townsend's big-ear bat (*Eptesicus fuscus*), and spotted bat (*Euderma maculatum*).

Desert habitats also support several wide-ranging carnivores including the coyote (*Canis latrans*), desert kit fox (*Vulpes macrotis*), ringtail (*Bassariscus astutus*), long-tailed weasel (*Mustela frenata*), American badger (*Taxidea taxus*), mountain lion (*Puma concolor*), and bobcat (*Lynx rufus*) (Navy 1989b, 1998, 2004). The common gray fox (*Urocyon cinereoargenteus*) occurs in pinyon pine and other woodlands. Larger mammals include mule deer (*Odocoileus hemionus*), Nelson's bighorn sheep (*Ovis canadensis nelsoni*), and feral horses and burros (Navy 1989a, 1989b, 1997, 2004). The current status of the feral horses and burros found on NAWS-CL is discussed below.

3.1.2.5.1 Feral Horses and Burros

Feral burros can be found in the Coso and Argus Ranges in the North Range and the Eagle Crags, Slate, and Brown Mountains on the South Range. Their movements and distribution are generally temperature related. During the summer months, burros may become somewhat solitary and will often retreat to the higher elevations and canyons with reliable sources of water. In the late fall, burros may move down to lower elevation alluvial fans and valleys throughout the Creosote Bush Scrub and Mojave Mixed Woody Scrub zones. During periods of moderate to heavy rainfall, and particularly during the springtime, they will disperse many miles from perennial water sources in search of green vegetation.

Wild horses use portions of the North Range at NAWS-CL and surrounding BLM lands on a yearlong basis. The current horse population exceeds 450 (T. Campbell, pers. com. 2013) individuals. The horses in the area of the Argus Range are generally located in the blackbrush (*Coleogyne ramosissima*) scrub, grass covered lava mesas, and Joshua Tree Woodland, where they can graze on remnants of bunch grasses and other vegetation. Horses are split into two key population centers: one in the southern portion of the Argus Range, in areas immediately north and south of Mountain Springs Canyon, and between Wilson Canyon and Shepard Canyon along the eastern boundary of the North Range; and the other in the Coso Range between Upper Cactus Flat and Coles Flat, and in the western and eastern portion of Wild Horse Mesa. Small, relatively isolated groups can be found throughout the remaining areas. Horses generally stay in the higher elevation areas during the spring and summer months and will often move down to lower elevation areas in the winter. While it is possible to see a few horses in lower elevations during any time of the year, most of the bands are rarely seen below 2,600 feet.

The California Desert Conservation Area Plan specifically addressed the issue of wild horse and burro management at NAWS-CL. The 1980 California Desert Conservation Area Plan determined that lands within NAWS-CL carried range resource capacity sufficient to support a target population of 168 horses and 1,137 burros. In 1984 this plan was further amended to state that the target population of burros would be 0. The California Desert Conservation Area Plan was again amended in 1999 as a result of the 1994 California Desert Protection Act (CDPA). The amended California Desert Conservation Area Plan states that, "Herd Management Areas

will not be established on military land." As a result, the Centennial Herd Management Area was established, but not does overlie any military land, and the Slate Management Area was no longer considered to be burro habitat. The CDPA assigned management of NAWS-CL lands and resources to the Secretary of the Navy (CDPA 1994).

The CDPA (Public Law 103-433-October 31, 1994, Section 805[g][4]) states: "The Secretary of the Navy shall be responsible for the management of wild horses and burros located on the NAWS-CL lands and may use helicopter and motorized vehicles for such purposes." The CDPA also required that an Interagency Agreement for cooperative management be initiated between the Secretary of the Navy and the Secretary of the Interior. The CDPA and the Wild Free Roaming Horse and Burro Act provide specific requirements and recommendations on the management of wild horse and burro herds including but not limited to:

- Maintaining a current inventory of wild free roaming horses and burros on their given public lands;
- If an overpopulation exists on a given area of the public lands and action is necessary to remove excess animals, the Secretary of the Interior shall immediately remove excess animals from the range so as to achieve AMLs; and,
- The Secretary of the Interior shall contract for a research study of such animals (BLM 1971).

The land withdrawal for NAWSCL was recently renewed with the signing of the Fiscal Year (FY) 2014 National Defense Authorization Act (NDAA) on December 26, 2013. The FY 2014 NDAA includes provisions for continued Navy management of wild horses and burros on essentially the same basis as previously set forth in the California Desert Protection Act of 1994.

It is projected that if the Herd is not more actively managed (than the status quo partial implementation of the 2000 INRMP and current management strategies), after 11 years the Herd would grow to over 1,500 animals with the assumptions of a starting herd population of 532 horses, a 16% reproductive rate, and the removal of 40 horses per year. This population value is approximately nine times the upper limit of the AML for the horse herd at NAWS-CL.

3.1.2.6 Effects on Wildlife Populations

A summary of projects and objectives for each of the alternatives that would potentially affect wildlife populations at NAWS-CL is provided below (Table 3-6).

3.1.2.6.1 Alternative 1

Revised Integrated Natural Resources Management Plan Implementation

All wildlife species would benefit from the Revised INRMP's focus on increasing overall knowledge of wildlife species. Alternative 1 would continue to encourage data collection (through baseline and NAWS-CL Special Status species surveys) of wildlife populations when possible, as this is important in filling in the data gaps that still exist with presence, taxonomy,

distribution, and habitat associations of wildlife populations. The data obtained from surveys and through continued support of cooperative agreements, partnerships, and university/non-profit led research would increase the ability of the Station to proactively manage species.

Table 3-6 Summary of projects and objectives intended for wildlife populations at Naval Air Weapons Station China Lake set forth by the alternatives.

Resource Area	Alternative 1: Implement the Revised INRMP including the WHBMP	No Action Alternative: Retain the 2000 INRMP and Current Horse and Burro Management Strategies
Invertebrates	Continue to support invertebrate studies through cooperative agreements, contracts, and other means.	Same as Alternative 1.
Fishes	Continue annual monitoring of focus species. Continue resource avoidance, minimization, and conservation measures, and reduce potential of conflict with the military mission. Continue to encourage research partnerships with other agencies, organizations, and researchers to further develop information on the plants and animals at NAWS-CL.	Same as Alternative 1.
Reptiles and Amphibians	Map potential habitats for focus species. Maps should emphasize geomorphic substrates and vegetation-based wildlife-habitat relationships. Consider using the California Gap Analysis Program as a model. Conduct surveys to determine the status and distribution of Chuckwalla, Panamint Alligator Lizard, Gilbert's Skink, Red Spotted Toad, Slender Salamander, and other NAWS-CL Sensitive reptiles and amphibians. Extirpate non-native amphibians from water sources, such as bullfrogs from the north channel of Lark Seep. Participate in the U.S. Department of Defense Partnership on Amphibian and Reptile Conservation as it becomes established.	Protect known and potential habitat and support research that adds knowledge of herpetological resources at NAWS-CL. Continue to conduct and support baseline surveys for data on species distributions, densities, host plants, and other valuable scientific data.

Resource Area	Alternative 1: Implement the Revised INRMP including the WHBMP	No Action Alternative: Retain the 2000 INRMP and Current Horse and Burro Management Strategies
Birds	Operate within the parameters of the U.S. Department of Defense Readiness Waiver to the Migratory Bird Treaty Act. Implement annual reporting of migratory bird impacts from military operations if necessary. Continue to develop and refine surveying, techniques and minimization and mitigation measures for avian species. Continue to develop and enhance baseline data on population level (to facilitate assessment of the effects of readiness operations), presence, activity, and use areas for migratory birds. Include the development of a monitoring program for bird use and recovery in areas impacted by wildfires. Incorporate monitoring and reporting requirements from the Raven Memorandum of Understanding if applicable. Develop a habitat protection, enhancement and management plan for NAWS-CL Special Status Species building on habitat value and use area maps for birds. Consider enhanced management efforts at the wastewater treatment ponds. Continue to implement the NAWS-CL–USFWS Inyo California towhee Cooperative Management Agreement intended to facilitate delisting of this species. Continue to work with other wildlife management agencies on bird census, survey, trapping, banding, and translocation efforts.	Maintain quality habitat to ensure foraging and resting areas are maintained. Water sources are of utmost importance. Continue to develop and enhance baseline data on presence, activity, and use areas for migratory birds. Continue to record BASH incidents. Continue to work with other wildlife management agencies on bird census, survey, trapping, banding, and translocation efforts. Continue to implement the NAWS-CL–USFWS Inyo California towhee Cooperative Management Agreement intended to facilitate delisting of this species.
Mammals	Conduct genetic and taxonomic studies on the vole and shrew populations. Consider conducting additional surveys to determine the range of these animals. Consider installation of bat gates at mines used as roost or maternity colonies, including Redwing mine, lower Star of the West mine, and Josephine mine. Continue to monitor the status of bighorn sheep and other NAWS-CL Special Status species. Conduct additional mammal surveys and assessments as needed. Continue to support research requests from outside agencies and organizations. Continue to support research efforts for Mohave ground squirrel. Implement combination of management strategies from the WHBMP	Consider installation of bat gates at mines used as roost or maternity colonies, including Redwing mine, lower Star of the West mine, and Josephine mine. Continue to monitor the status of bighorn sheep and other NAWS-CL Special Status Species. Conduct additional mammal surveys and assessments as needed. Continue to support research requests from outside agencies and organizations. Continue to implement Current Wild Horse and Burro Management Strategies.

Under Alternative 1 invertebrate species would benefit from the protection of key habitat around seeps and springs. Additionally, as much of the knowledge of invertebrate species on the Station has been obtained through university-led research, knowledge of invertebrates would continue to be bolstered by the promotion of this work.

Fishes under Alternative 1 would benefit from removal of invasive species in the seeps, as the habitat for fish species is extremely limited at NAWS-CL.

Alternative 1 would benefit amphibian and reptile populations from participation in U.S. Department of Defense Partners in Amphibians and Reptiles Conservation and HerpNET, when possible, in an attempt to better document, inventory, and manage reptile and amphibian species found on NAWS-CL. Removal of invasive species from water resources (tamarisk, etc.) would increase the value of amphibian habitat on NAWS-CL. NAWS-CL would map potential habitat and survey for NAWS-CL Sensitive reptiles and amphibians, furthering the knowledge of these resources on the Station.

The Revised INRMP calls for extensive monitoring to develop and enhance baseline data for birds on the Station. Birds species at NAWS-CL would benefit from the implementation of the Revised INRMP as it protects (by the fencing of springs) water resources that are vital habitat for many migratory birds. Continued removal of invasives from water resources would also increase the value of this habitat for avian species.

Mammalian species would continue to be surveyed as needed under the Revised INRMP. Mammalian species would benefit from the knowledge gained through research efforts on the Mohave ground squirrel, studies of the vole and shrew populations on the Station, and through continued support of additional mammalian research/surveys. Bat populations would benefit from the as-needed installation of bat gates and subsequent protection of roosting habitat. The protection of water resources (through fencing and invasive species removal) under Alternative 1 would benefit mammalian species by ensuring that the limited water resources on NAWS-CL remain intact.

The extensive monitoring, surveying, and management efforts, coupled with the protection of vital water resources under Alternative 1, would have moderate beneficial effects on wildlife populations.

Wild Horse and Burro Management Plan Implementation

Direct impacts associated with wild horse and burro gathers would consist of disturbance of the areas in and immediately around the gather site(s) and temporary holding facilities. The likelihood of these instances having impacts to biological resources is low, as locations chosen for such activities are selected to be in areas without many high value resources (i.e., roads and previously disturbed areas).

Many terrestrial and ground-dwelling species are currently adversely affected by the presence of horses and burros (Herd population currently estimated between 450-500 individuals [T. Campbell pers com 2013). Horses and burros can trample individuals either on the ground or in burrows. Horse and burro movement also damages plants that may be used by wildlife species for forage, shelter, or nesting locations.

Additionally, horses and burros spend a disproportionately high amount of time at water resources (Navy 2013b). The water resources at NAWS-CL provide riparian/upland habitat, both

of which are scarce on the Station. A reduction in wild horse and burro numbers would benefit species dependent upon these resources (i.e., Inyo California towhee).

Wildlife populations would benefit from implementation of the WHMBP under Alternative 1. Any combination of the four described management strategies (in Section 2.2.1) could be used to reach AMLs of zero burros and 100-168 horses Reaching AML's for wild horse populations and burro populations would reduce impacts to the native ecosystems that wildlife populations depend upon. Achieving an AML would reduce inter-species competition for forage and water resources, thus benefiting wildlife populations.

The implementation of Alternative 1 would dramatically lower the number of horses at NAWS-CL through removals and fertility control. This lower number would allow the populations to avoid boom and bust cycles that would otherwise occur. Horses would be healthier and better able to survive stressful periods, such as prolonged droughts and harsh winters. This smaller population would be more sustainable.

Alternative 1 would also call for NAWS-CL to implement Herd monitoring measures to assess and ensure that the genetic viability and diversity of the Herd is maintained. Blood and hair samples would be collected for genetic testing. The WHBMP would implement genetic testing every ten to 15 years and more frequently if there is a recognized concern regarding low genetic diversity (Navy 2013b). Achieving the AML of 100-168 horses would keep the Herd at an effective genetic population size, which is commonly recognized as 50 individuals. Genetic diversity is low but not critical. Additionally, NAWS-CL would record the total number of adults and foals, along with each animal's body condition, sex, and age to better monitor the Herd.

Thus the implementation of the WHBMP would reduce the size of the Herd, therefore providing benefits to species currently impacted by their presence on the Station. Additionally, the Herd, once down to an AML, would become more sustainable, less affected by extreme environmental conditions, and would have a regularly monitored genetic composition.

There would be beneficial impacts to wildlife populations at NAWS-CL from implementation of Alternative 1. Therefore, there would be no significant impacts from the implementation of the Revised INRMP including the WHBMP.

3.1.2.6.2 No Action Alternative

Retain the 2000 Integrated Natural Resources Management Plan

The Revised INRMP retains and continues the majority of the projects and objectives currently utilized under the 2000 INRMP. As such, the 2000 INRMP would continue to implement adaptive management strategies for wildlife populations. The Station would continue to conduct surveys for, and support surveys/research that, garnered knowledge of species presence, distributions, densities, ranges, and area uses.

Current Horse and Burro Management Strategies Implementation

The effects to wildlife populations (including invertebrates, reptiles/amphibians, birds, and mammals) from the wild horse and burro management portion of the No-Action Alternative (2000 INRMP) would generally be the same as described for Alternative 1 (Revised INRMP). This is because the 2000 INRMP and the Revised INRMP both have the objective of achieving and maintaining the Centennial Horse Herd to fewer than 168 animals, which is the AML identified in the California Desert Conservation Area Plan. The AML is considered to be the number of horses that NAWS-CL lands can successfully sustain without long term impacts to its natural resources. Both the 2000 INRMP and the Revised INRMP include horse roundups as a management strategy to reduce the numbers of horses, and the only difference between the INRMP versions is that in addition to roundups, the Revised INRMP also provides for the use of other management strategies to reach the AML. Both INRMP versions contain the objective of achieving and maintaining a wild burro population of zero on NAWS-CL. Therefore, implementation of the No-Action Alternative would not result in significant impacts to wildlife populations.

3.1.3 Special Status Plant Species

To better track and manage the unique set of organisms found at NAWS-CL, the 2000 INRMP established a list of NAWS-CL Special Status Species. NAWS-CL Special Status Species are defined as those species that are not protected under federal law, but are considered important components of the Installation's biotic system and are categorized as special-status species by various federal and state resource agencies. A species may be considered NAWS-CL Special Status Species if it has a limited range, is endemic to a particular area, is of questionable or unclear taxonomic status, or is of scientific interest. NAWS-CL also considers those species exhibiting unique or rare features (such as creosote clones or Joshua tree spikes), and those occurring in a known valuable habitat or in a protected habitat as warranting stewardship. However, per the Sikes Act, stewardship and conservation of natural resources are to be conducted without compromising the military mission. Should a NAWS-CL Special Status Species be identified in an area that may be affected by a proposed project or activity, efforts are made to avoid or minimize impacts to these resources whenever practicable in light of military mission requirements. Additionally, NAWS-CL Special Status species are defined in both the Comprehensive Land Use Management Plan and the INRMP, and include both plants and animals that are not federally protected now but are either state listed or on watch lists as a result of a species-limited distribution or other risk factors. These watch lists and other factors are described for NAWS-CL sensitive plant and wildlife species.

Although there are no federally or state listed plant species at NAWS-CL, there are numerous plants either known or with the potential to occur (based on available habitat and range) that are considered to be special status (see Table 3-7), based upon the following criteria:

- Federally listed species (with populations confirmed adjacent to Station boundary);
- Proposed for federal listing or a former USFWS Category 2 or 3 species;

- Are unconfirmed taxonomically (i.e. specimens not confirmed as definitely matching a known rare species but similar enough to warrant tracking for further study);
- Are listed by the California Native Plant Society (CNPS) as being rare or of limited distribution (CNPS status 1B); and,
- Are found on the BLM Sensitive Species list or U.S. Forest Service Significant Species list

The conservation of special status plant and animal species is a management goal of the INRMP, and they are provided management consideration during the land use planning process defined in the Comprehensive Land Use Management Plan. The Sikes Act requires that an INRMP provide for "no net loss in the capability of the military Installation lands to support the military mission of the installation." The purpose of the INRMP is to accommodate mission requirements while meeting natural resource compliance responsibilities.

Should a NAWS-CL Special Status Species be identified in an area that may be affected by a proposed project, efforts are made to avoid or minimize impacts to these resources whenever practicable in light of military mission requirements. However, they are not afforded the level of protection required for species listed under the federal Endangered Species Act or other federal law.

Table 3-7 Special status plant species that occur or have potential to occur at Naval Air Weapons Station China Lake.

Common Name Scientific Name	North or South Complex	Associated Plant Community	Status
Species Presence Confirmed at NAWS-CL			
Great Basin onion *Allium atrorubens* var. *atrorubens*	North	Pinyon and Juniper Woodland, Great Basin Mixed Scrub	CNPS 2.3
Pinyon rock cress *Arabis dispar* (*Boechera d.*)	North	Pinyon Woodland, Great Basin Mixed Scrub, Sagebrush Scrub, Joshua Tree Woodland, Blackbush Scrub	CNPS 2.2, NAWS 2a
Darwin Mesa milkvetch *Astragalus atratus* var. *mensanus*	North	Pinyon Woodland, Great Basin Mixed Scrub, Sagebrush Scrub, Joshua Tree Woodland, Blackbush Scrub	CNPS 1B.1, BLM, NAWS 2a
Booth's camissonia *Camissonia boothii* subsp. *boothii*	North	Joshua Tree Woodland, Pinyon and Juniper Woodland	CNPS 2.2, NAWS 2b
Desert bird's-beak *Cordylanthus eremicus* subsp. *eremicus*	North	Pinyon Woodland, Great Basin Mixed Scrub, Sagebrush Scrub, Joshua Tree Woodland, Blackbush Scrub, Desert Transition Scrub	CNPS 4.3, NAWS 2a
Clokey's cryptantha *Cryptantha clokeyi*	South	Creosote Bush Scrub, Mojave Mixed Scrub	CNPS 1B.2
Desert cymopterus *Cymopterus deserticola*	South	Joshua Tree Woodland, Mojave Desert Scrub	CNPS 1B.2
Panamint dudleya *Dudleya saxosa* subsp. *saxosa*	South	Mojave Desert Scrub, Pinyon and Juniper Woodland	CNPS 1B.3, NAWS 2c
Pinyon Mesa buckwheat *Eriogonum mensicola*	North	Great Basin Scrub, Pinyon and Juniper Woodland, Upper Montane Coniferous Forest	CNPS 1B.3

Common Name Scientific Name	North or South Complex	Associated Plant Community	Status
Panamint Mountains buckwheat *Eriogonum microthecum* var. *panamintense*	North	Pinyon and Juniper Woodland, Subalpine Coniferous Forest	CNPS 1B.3
Yerba desierto *Fendlerella utahensis*	North	Pinyon Woodland, Great Basin Mixed Scrub, Desert Transition Scrub	CNPS 4.3, NAWS 2b
Inyo hulsea *Hulsea vestita* subsp. *inyoensis*	North	Chenipod Scrub, Great Basin Scrub, Pinyon and Juniper Woodland	CNPS 2.2, NAWS 2b
Creosote clones *Larrea tridentata*	North	Mojave Sand Field	Scientific Value (age)
Coso Mountains lupine *Lupinus magnificus* var. *glarecola*	North	Pinyon Woodland, Great Basin Mixed Scrub, Sagebrush Scrub, Joshua Tree Woodland, Blackbush Scrub	CNPS 4.3
Creamy blazing star *Mentzelia tridentata*	North	Mojave Desert Scrub	CNPS 1B.3
Crowned muilla *Muilla coronata*	North	Joshua Tree Woodland, Blackbush Scrub, Desert Transition Scrub, Mojave Mixed Scrub, Hopsage Scrub, Shadscale Scrub, Creosote Bush Scrub	CNPS 4.2, NAWS 2b
Oppressed muhly *Muhlenbergia appressa*	South	Coastal Scrub, Mojave Desert Scrub, Valley and Foothill Grassland	CNPS 2.2
Amargosa beardtongue *Penstemon fruticiformis* var. *amargosae*	North	Mojave Desert Scrub	CNPS 1B.3, BLM
Mono County phacelia *Phacelia monoensis*	South	Pinyon and Juniper Woodland, Great Basin Mixed Scrub, Clay, Roadsides, Alkaline Meadows	CNPS 1B.3, NAWS 2a
Death Valley round-leaved phacelia *Phacelia mustelina*	South	Joshua Tree Woodland, Blackbush Scrub, Mojave Mixed Scrub	CNPS 1B.3, NAWS 2a
Charlotte's phacelia *Phacelia nashiana*	North	Joshua Tree Woodland, Mojave Mixed Scrub, Hopsage Scrub, Shadscale Scrub, Creosote Bush Scrub	CNPS 1B.2, BLM, NAWS 2a
Mohave indigo bush *Psorothamnus arborescens* var. *arborescens*	South	Joshua Tree Woodland, Blackbush Scrub, Mojave Mixed Scrub, Hopsage Scrub	CNPS 4.3, NAWS 2a
Mohave fish-hook cactus *Sclerocactus polyancistrus*	Both	Great Basin Mixed Scrub, Joshua Tree Woodland, Blackbush Scrub, Desert Transition Scrub, Mojave Mixed Scrub, Shadscale Scrub, Creosote Bush Scrub	CNPS 4.2, NAWS 2a
DeDecker's clover *Trifolium macilentum* var. *dedeckerae*	North	Pinyon Woodland	CNPS 1B.3, BLM, NAWS 2b
Species with Unconfirmed Records at NAWS-CL			
Shining milkvetch[1] *Astragalus lentiginosus* var. *micans*	North	Creosote Bush Scrub, Saltbush Scrub, Alkaline Basin Scrub	CNPS 1B.2, NAWS 1b
Naked milkvetch *Astragalus serenoi* var. *shockleyi*	North	Sagebrush Scrub, Pinyon Pine	CNPS 2.2, NAWS 2b
Panamint mariposa lily *Calochortus panamintensis*	North	Pinyon Woodland, Great Basin Mixed Scrub, Sagebrush Scrub	CNPS 4.2, NAWS 2b
Winged cryptantha *Cryptantha holoptera*	Both	Mojave Desert Scrub, Sonoran Desert Scrub	CNPS 4.3

Common Name Scientific Name	North or South Complex	Associated Plant Community	Status
Caespitose evening-primrose *Oeonothera caespitosa* subsp. *crinita*	North	Mixed Desert Scrub, Pinyon Woodland, Bristlecone Pine Forest, Subalpine Coniferous Forest	CNPS 4.2, NAWS 2b
Species with Suitable Habitat at NAWS-CL, but No Documented Occurrences			
Darwin rock cress *Arabis pulchra* var. *munciensis*	Both	Chenopod Scrub, Mojave Desert Scrub	CNPS 2.3, NAWS 2c
Lane Mountain milkvetch *Astragalus jaegerianus*	South	Creosote Bush Scrub, Joshua Tree Woodland	FE, CNPS 1B.1, NAWS 1a
Pygmy poppy *Canbya candida*	North	Joshua Tree Woodland, Mojave Desert Scrub, Pinyon and Juniper Woodland	CNPS 4.2, NAWS 2e
Barstow woolly sunflower *Eriophyllum mohavense*	South	Chenopod Scrub, Mojave Desert Scrub, Playas	CNPS 1B.2
Ripley's aliciella *Gilia ripleyi* (*Aliciella r.*)	South	Mojave Desert Scrub	CNPS 2.3

Status Codes:
FE = Federal Endangered
BLM = U.S. Bureau of Land Management Sensitive Plant
CNPS = California Native Plant Society; 1B = Rare, threatened, or endangered in California and elsewhere, 2 = Rare, threatened, or endangered in California, but more common elsewhere, 3 = We need more information about this plant (Review List), 4 = Limited distribution (Watch List).
NAWS = NAWS-CL Species of Concern; 1 = Status species, a = potential to occur at NAWS, b = possible occurrence at NAWS-CL but needing taxonomic study; 2 = Sensitive species, a = species known to occur at NAWS, b = possible occurrence at NAWS-CL but needing taxonomic study, c = species with suspect records at NAWS-CL requiring further review, e = potential sensitive species at NAWS.
[1]Shining milkvetch is locally common in the China Lake basin. However, further taxonomic determinations are necessary to verify the species.

Nine species in Table 3-7 are well known and documented at NAWS-CL, and records indicate that another eight species probably occur on the installation, but that further verification is needed. There are also five species for which the records are suspect, and which probably represent reporting errors or nomenclature changes (Navy 2000). Creosote bush clones are recognized by multiple agencies as ancient plant formations meriting conservation. Large individuals of the Mohave fish-hook cactus (*Sclerocactus polyancistrus*) on NAWS-CL are regionally important plants, due to their limited distribution.

3.1.3.1 Effects on Special Status Plant Species

A summary of projects and objectives for each of the alternatives that would potentially affect special status plant species at NAWS-CL is provided below (Table 3-8).

Table 3-8 Summary of projects and objectives intended for special status plant species at Naval Air Weapons Station China Lake set forth by the alternatives.

Resource Area	Alternative 1: Implement the Revised INRMP including the WHBMP	No Action Alternative: Retain the 2000 INRMP and Current Horse and Burro Management Strategies
Special Status Plant Species	Continue to conduct rare plant inventories in priority/likely areas. Prioritize searches based on habitat suitability, threats and vulnerabilities, on potential for locating endemics, and in under-represented areas.	Continue to conduct rare plant inventories in priority/likely areas.

3.1.3.1.1 Alternative 1

Revised Integrated Natural Resources Management Plan Implementation

With the implementation of Alternative 1, rare plant searches would take place and threats and vulnerabilities to known locations of special status plants and/or their communities would be identified.

There would be moderate beneficial impacts to special status plants at NAWS-CL from implementation of Alternative 1.

Wild Horse and Burro Management Plan Implementation

The Herd population is now 450-500 individuals (T. Campbell, pers. com. 2013), which is approximately three times the upper limit of the AML. Direct impacts associated with wild horse and burro gathers would consist of disturbance of the areas in and immediately around the gather site(s) and holding facilities. The likelihood of these instances having impacts to sensitive plant species is low, as locations selected for such activities are chosen to be in areas without many resources.

Indirect impacts of implementing Alternative 1 would be realized through a reduction of current horse populations. In areas where wild horse and burro populations overlap with rare plant populations, a reduction in the wild horse and burro populations would reduce the impacts from trampling, grazing, and foraging on special status plant populations. Competition for forage among wild horses, burros, and wildlife would be reduced as utilization levels decrease, allowing for the recovery of healthier vegetation communities.

There would be moderate beneficial impacts to special status plant species at NAWS-CL from implementation of the WHBMP under Alternative 1.

Therefore, there would be no significant impacts to special status plant species at NAWS-CL from the implementation of the Revised INRMP including the WHBMP.

3.1.3.1.2 No Action Alternative

Retain the 2000 Integrated Natural Resources Management Plan

With the implementation of Alternative 2, rare plant searches would continue take place in likely/priority areas. There would be moderate benefits to special status plant species through the implementation of the No Action Alternative.

Current Horse and Burro Management Strategies Implementation

The effects to special status plant species from implementation of the wild horse and burro management portion of the No-Action Alternative (2000 INRMP) would generally be the same as described for Alternative 1 (Revised INRMP). This is because the 2000 INRMP and the Revised INRMP both have the objective of achieving and maintaining the Centennial Horse Herd to fewer than 168 animals, which is the AML identified in the California Desert Conservation Area Plan. The AML is considered to be the number of horses that NAWS-CL lands can successfully sustain without long term impacts to its natural resources. Both the 2000 INRMP and the Revised INRMP include horse roundups as a management strategy to reduce the numbers of horses, and the only difference between the INRMP versions is that in addition to roundups, the Revised INRMP also provides for the use of other management strategies to reach the AML. Both INRMP versions contain the objective of achieving and maintaining a wild burro population of zero on NAWS-CL. Therefore, implementation of the No-Action Alternative would not result in significant impacts to special status plant species.

3.1.4 Special Status Wildlife Species

Five animal species recorded at NAWS-CL are federally listed as endangered (three species) or threatened (two species). However, as a practical matter, only three species present management issues for NAWS-CL, including: Mohave tui chub; Mohave Desert Tortoise; and Inyo California Towhee. The least Bell's vireo (*Vireo bellii pusillus*), southwestern willow flycatcher (*Empidonax traillii extimus*), and western snowy plover are all rare migrants through the region and do not present any specific management challenges. Additionally only the Pacific subpopulation of Western snowy plover is Federally Threatened, not the inland population. The mountain plover (*Charadrius montanus*) was recently a candidate for federal listing, and the state-listed Mohave ground squirrel was under review for listing, but neither became federally listed.

The Comprehensive Land Use Management Plan and INRMP indicate that NAWS-CL Special Status species have been determined based on one or more of the following criteria:

- Listed as threatened or endangered by the Federal Government
- Covered by the Migratory Bird Treaty Act
- Listed as threatened or endangered by the State;
- Proposed for federal listing or a former USFWS Category 2 or 3 species;
- State, BLM, or other agencies/organizations have identified them as warranting special management consideration (based on other resource agencies or professionally recognized organizations or specialists);
- Listed in the California Natural Diversity Data Base (CNDDB);
- Of scientific interest;
- Rare or endemic;
- Range extension;

- Unknown taxonomy (i.e., specimens not confirmed as definitely matching a known rare species but similar enough to warrant tracking for further study); or,
- Recognized by NAWS-CL technical staff as unique or of scientific interest.

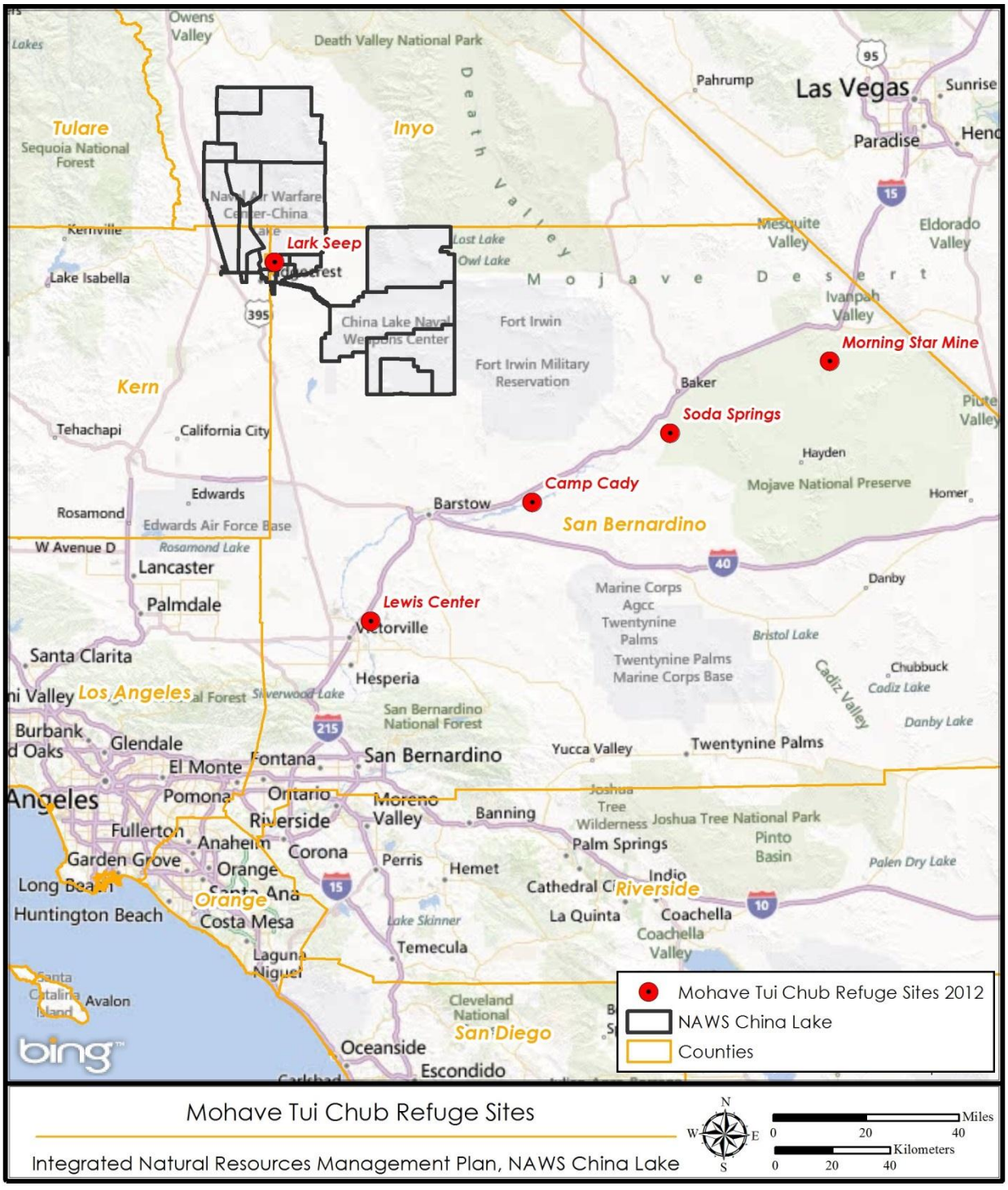
The following analysis focuses solely on the three federally-listed species that present management issues at NAWS-CL.

3.1.4.1 Mohave Tui Chub

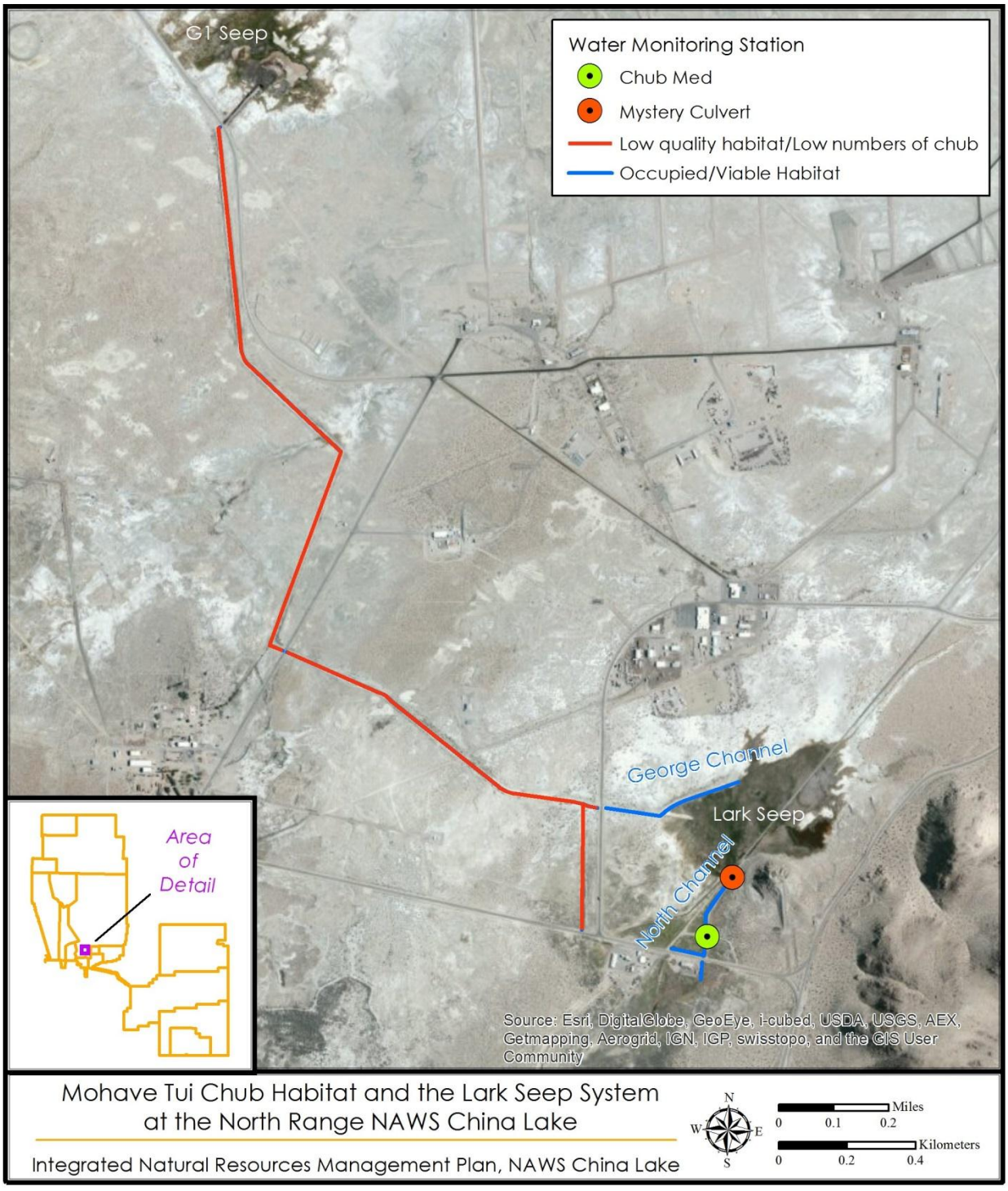
Mohave tui chub were historically restricted to the Mojave River from the base of the San Bernardino Mountains to its terminus at Soda Dry Lake, and were typically associated with deep pools and slough-like areas of the Mojave River. By 1967, few pure Mohave tui chub remained in the river (USFWS 1984), and the only native habitat where pure Mohave tui chub remained was at Soda Springs, located near the terminus of the Mojave River and adjacent to Soda Dry Lake near Baker, California. The Mohave tui chub no longer exist within the Mojave River, and were federally listed as endangered in 1970 and state listed as endangered in 1971. Current refuge sites for the Mohave tui chub and their status are depicted in Map 3-4. The location of Mohave tui chub and its habitat at NAWS-CL are depicted in Map 3-5.

In 1972, in an attempt to preserve this population at Soda Springs, several refuges were created by the USFWS and the California Department of Fish and Wildlife (CDFW),[1] and chub were transplanted from Lake Tuendae (the largest of the three habitats at Soda Springs) to 14 sites. Only three transplants were successful: the Desert Research Station, Hinkley; California Information Center, Barstow; and Lark Seep System, NAWS-CL.

[1] CDFW was formerly the California Department of Fish and Game. The acronym 'CDFW' will be used in this document, except when citing documents that were published prior to the Department's name change (January 1, 2013).



Map 3-4. Mohave tui chub refuge sites in southern California.



Map 3-5. Mohave tui chub habitat at Naval Air Weapons Station China Lake.

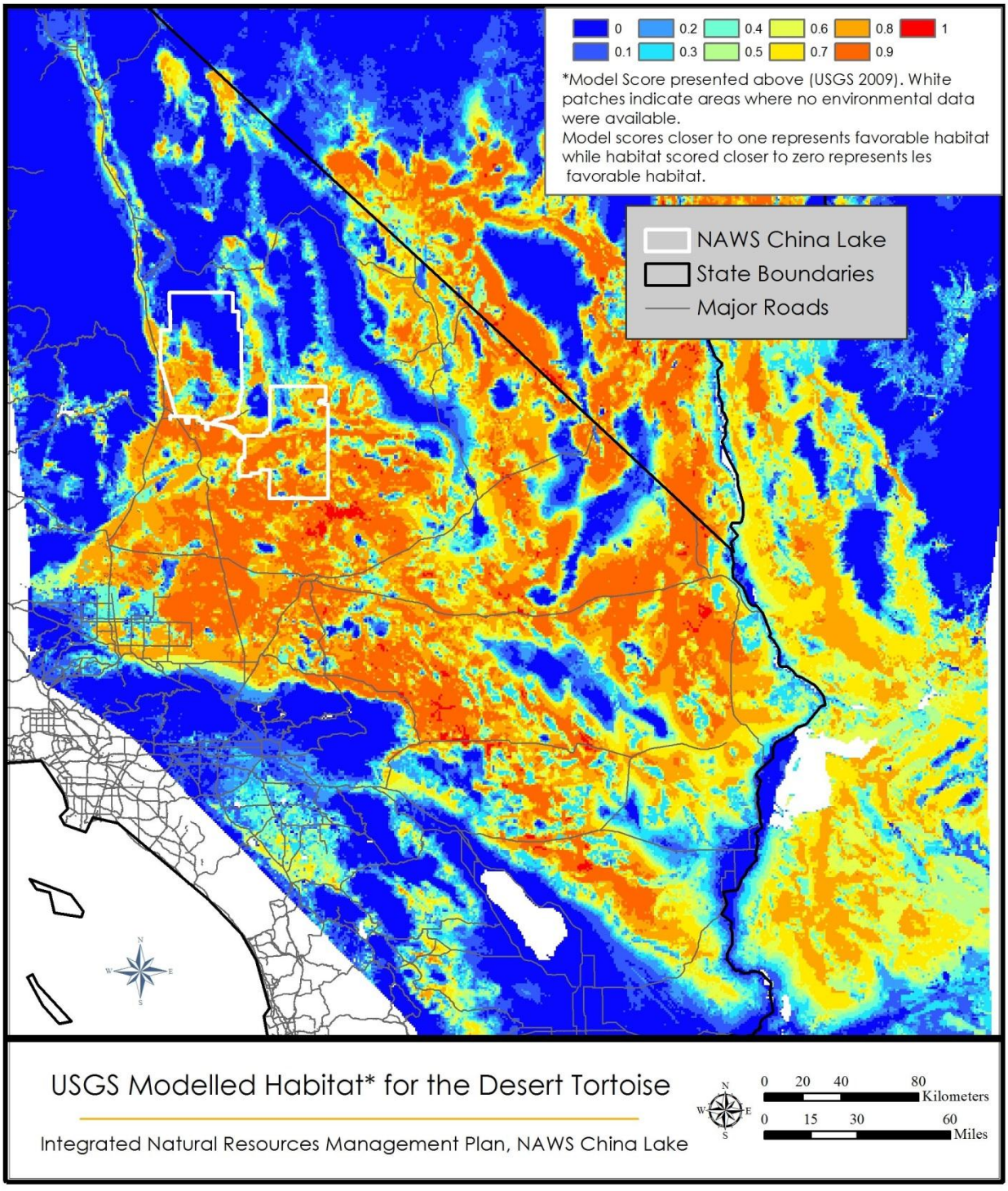
The largest known population of Mohave tui chub is in the Lark Seep System on NAWS-CL. The Lark Seep System consists of two seeps and about two and a half miles of interconnecting channels. Initially, 400 chub were introduced into the Lark Seep lagoon in 1972 (St. Amant and Sasaki 1971). This introduction was augmented with 75 additional chub in 1976 (Hoover and St. Amant 1983). Considerable monitoring of the Lark Seep System occurred in 1983 (Feldmeth 1984), 1988 (Feldmeth et al. 1989), and 1991 (Feldmeth and Bilhorn 1991). These studies documented important features of the system, including groundwater regime, water quality parameters, biotic characteristics, and chub ecology.

Current monitoring of the Mohave tui chub supports the findings of the earlier monitoring programs conducted in the 1980s and 1990s. Population estimates from the late 1990s ranged from 3,143 to 10,405, but all had very high confidence intervals, displaying a high level of accuracy. More recent monitoring of the Mohave tui chub includes the following studies: a 2002 viable habitat study in all possible habitats; November 2004 mark and recapture sampling effort along the George and G1 channels; October 2007 survey in the North Channel; April 2008 mark and recapture sampling effort along North Channel; October 2008 mark and recapture sampling effort in G1 channel; and mark and recapture sampling in the fall of 2009, 2010, 2011, and 2012. During relative abundance sampling in 2008, 2,634 individuals were captured (of which 541 were translocated to the Lewis Center) (Map 3-4). In 2010, 1,104 individuals were captured in relative abundance sampling, while 3,638 were captured in absolute abundance sampling. Based on the number captured, tagged, and then recaptured, the total population in 2010 was estimated at 4,844 (95% CI - 4,571-5,133) (Desert Mountain RC&D Council 2011).

3.1.4.2 Mohave Desert Tortoise

The Mohave Desert Tortoise occurs in a wide variety of habitats throughout the Mojave and Sonoran Deserts. Tortoises prefer Creosote Bush Scrub communities, where precipitation ranges from 2–8 inches annually and perennial and ephemeral plant species are abundant. Mohave Desert Tortoise populations were state listed as threatened in 1989 and federally listed as threatened in 1990. Mohave Desert Tortoise populations have declined dramatically in the last 25 years. In some areas of occupied habitat, tortoise density has dropped 50 to 90 percent near some desert towns (Berry 1999, 2003). Modeled habitat for the Mohave Desert Tortoise is depicted in Map 3-6 (U.S. Geological Survey 2009).

Adult tortoises average 9 to 15 inches in upper shell (carapace) length. The Mohave Desert Tortoise digs underground burrows, where it spends at least 95% of its life. These burrows allow the tortoise to live underground, avoiding surface temperatures that may exceed 140 degrees Fahrenheit. From October to February, the Mohave Desert Tortoise aestivates in its burrow to protect against freezing weather. Much of the tortoise's water intake comes from moisture in the grasses and wildflowers consumed in the spring. Adult tortoises may survive a year or more without access to water.



Map 3-6. United States Geological Survey (2009) modeled habitat for the Mohave Desert Tortoise.

The central strategy for saving the Mohave Desert Tortoise, pursuant to the 1994 Recovery Plan (and furthered by the 2011 Revised Recovery Plan), has been the establishment of Desert Wildlife Management Areas, designed to provide special protection for the tortoise and other wildlife. The Recovery Plan described the special management actions to be implemented in each Desert Wildlife Management Area to protect and recover the Mohave Desert Tortoise. NAWS-CL tortoise populations are within the West Mojave Recovery Unit, which has sustained severe and rapid populations declines of up to 10% or more annually from about 1980 to 1988 (BLM 1988). In 2008, the USFWS issued a Revised Recovery Plan which emphasizes partnerships to direct and maintain focus on recovery action implementation.

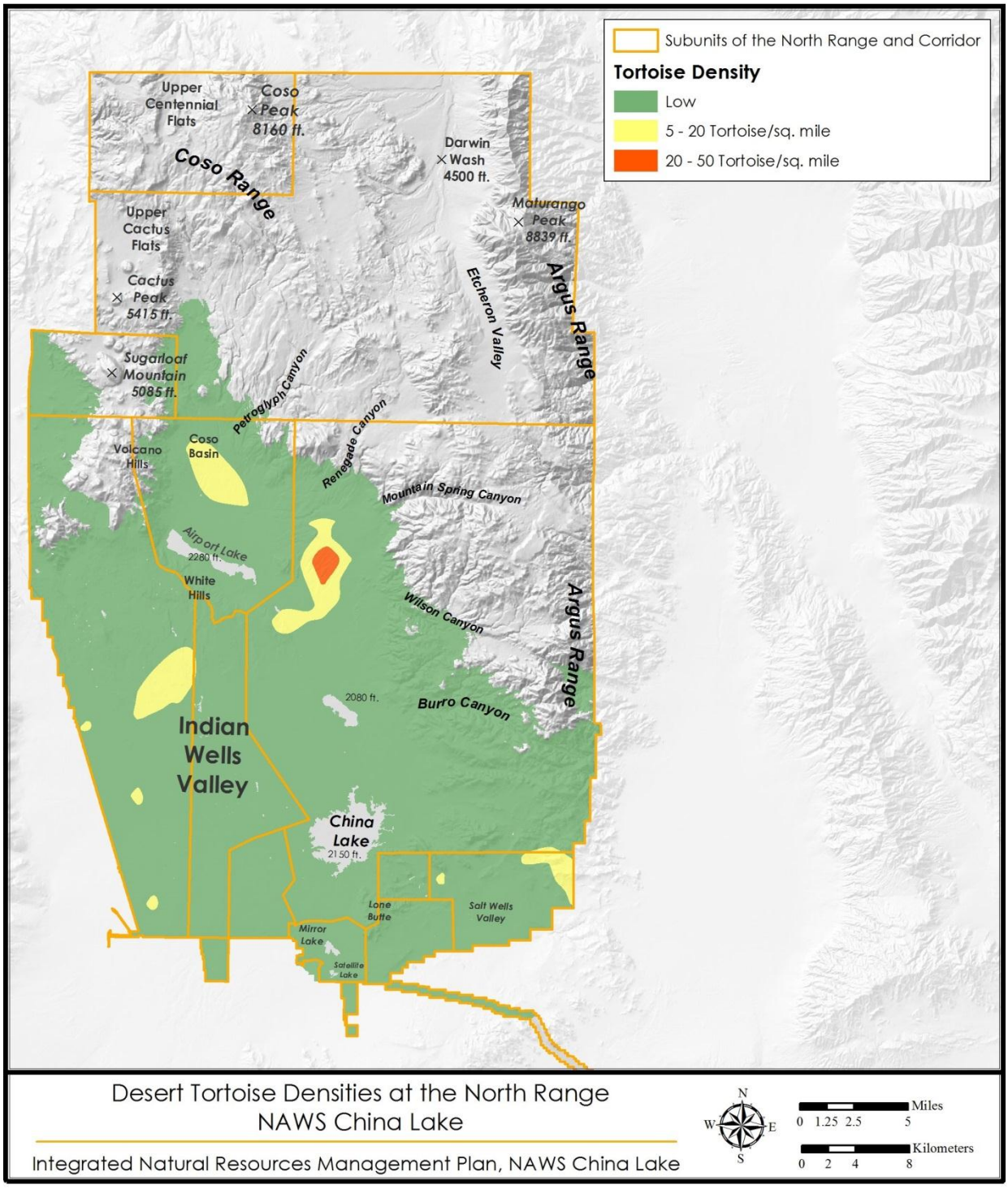
At NAWS-CL, tortoises are found in the Creosote Bush Scrub, Shadescale and Saltbush Scrub, and Mojave Mixed Woody Scrub (USFWS 1995). A survey of the North and South Ranges was conducted by Kiva Biological Consulting in 1990 and 1991 and was repeated in 2004 by Epsilon Systems. Relative abundance transects conducted in 2004 on the North and South Ranges indicate that tortoises have a wide distribution on NAWS-CL (Kiva Biological Consulting 2005). Estimated tortoise densities for the North and South Ranges are depicted in Map 3-7 and Map 3-8.

The Mohave Desert Tortoise population at NAWS-CL is managed under a BO (that can be found in the Appendix section of the Revised INRMP) issued by the USFWS in February 2013 (superseding the 1995 BO). This BO calls for (but is not limited to) the following measures: continuing control of invasive species; continuing control of wild horses and feral burros; undertaking plant and animal species surveys of the target and test site buffers; adaptive fire management measures and conducting post-project monitoring of certain activities that have the potential to affect federally listed species (USFWS 2013).

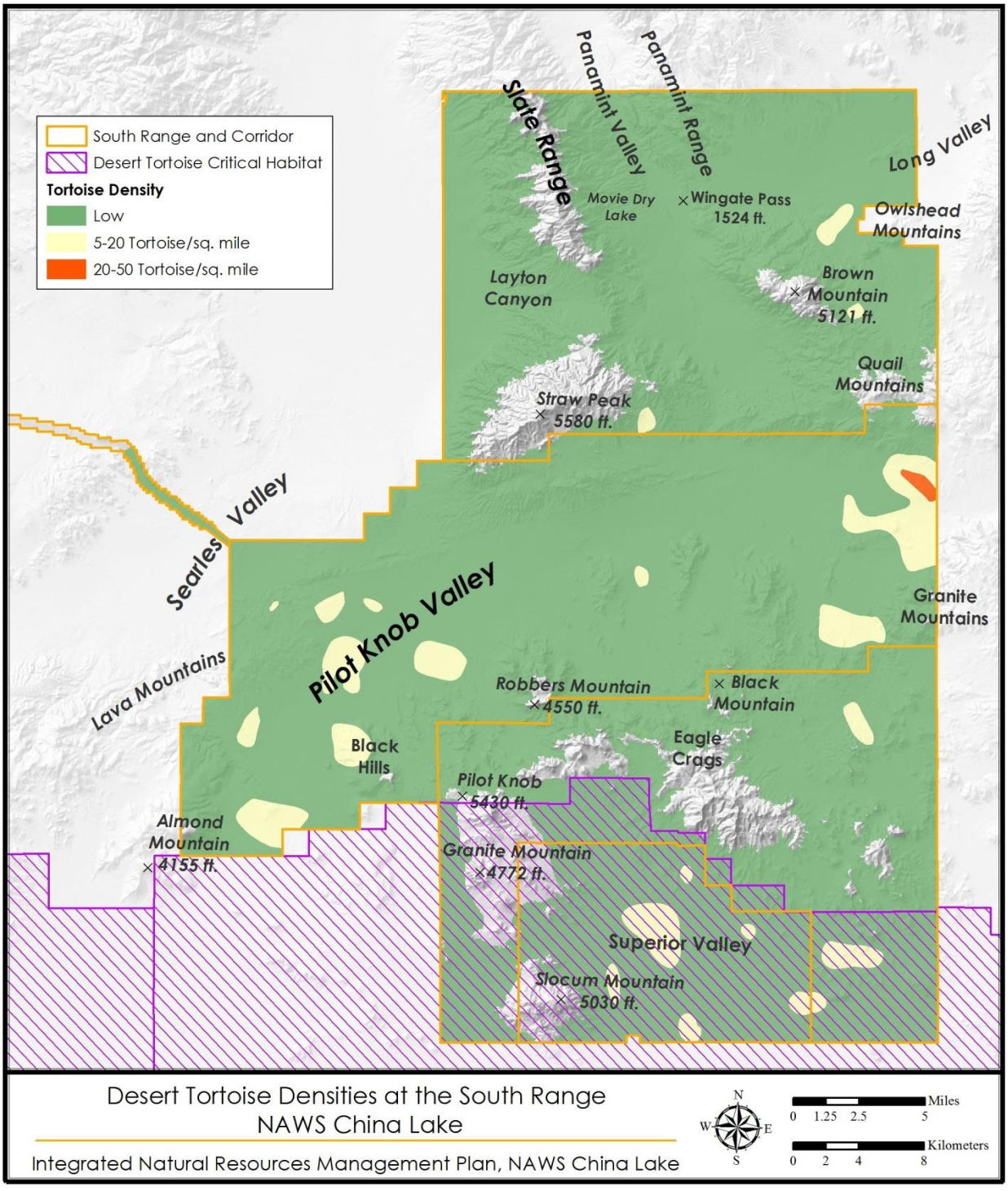
3.1.4.3 Inyo California Towhee

Inyo California towhees are essentially non-migratory (Childs 1968; LaBerteaux 1989); however, during extreme winter weather they may move altitudinally. Territories are centered on desert riparian vegetation but range into adjacent upland plant communities such as Mojave Creosote Bush Scrub, Mojave Mixed Woody Scrub, Blackbrush Scrub, or Big Sagebrush Scrub (Holland 1986) with or without a Joshua tree overstory (LaBerteaux 1989, 1994).

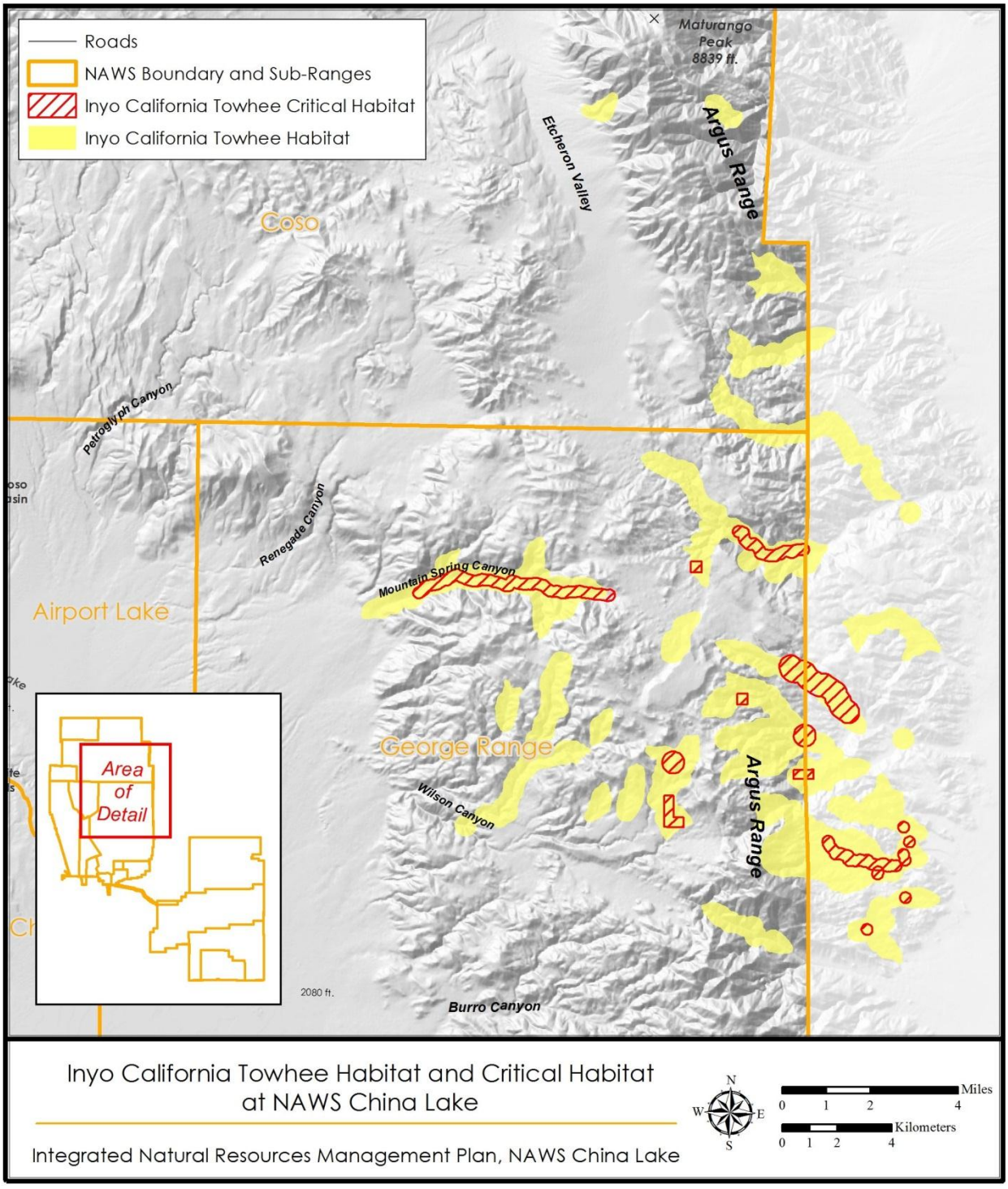
While California towhees (*Melozone crissalis*) are widespread across western California, the Inyo population is confined to a very limited area in the Mojave Desert. Its preferred canyon riparian habitat has been historically degraded by cattle, horses, burros, mining, and fire (burnt bare ground usually re-vegetated by non-native invasive plants), and could be further adversely impacted by future land use changes (USFWS 1987). For these reasons, the Inyo California towhee was state listed as endangered in 1980 and federally listed as threatened in 1987 (USFWS 1987; California Department of Fish and Game 1980). Critical habitat was designated in 1987 (USFWS 1987) (Map 3-9) and a recovery plan was completed by the USFWS in April 1998 (USFWS 1998). In October 2008, the USFWS published a five-year review with recommendations for delisting the Inyo California towhee (USFWS 2008).



Map 3-7. Estimated tortoise densities at the North Range, Naval Air Weapons Station China Lake.



Map 3-8. Estimated tortoise density, Critical Habitat, and the Mohave Desert Tortoise Habitat Management Area at the South Range, Naval Air Weapons Station China Lake.



Map 3-9. Inyo California towhee habitat and Critical Habitat at Naval Air Weapons Station China Lake.

Until recently, the total known range of the Inyo California towhee was thought to lie within a 14-mile diameter circle in the southern Argus Mountains (the species is now found in an estimated 32 miles of canyons), randomly distributed in riparian habitat between 2,680 and 5,630 feet above mean sea level, ranging from Indian Joe Canyon in the south to Mountain Springs Canyon and Water Canyon in the north. Previously, numbers of Inyo California towhees had been estimated between 138 (Cord and Jehl 1979) and 180 adults (LaBerteaux 1994). The most recent population censuses in 2004 (on BLM land) and 2007 (on NAWS-CL) documented a total population between 706 and 741 adults (USFWS 2008).

In July 2009, a Cooperative Management Agreement (CMA) was issued by the USFWS and adopted by the BLM, CDFW, and NAWS-CL. This agreement requires that NAWS-CL continue to "consider and avoid (to the maximum extent possible) potential impacts during planning efforts, remove feral burros and horses from the towhee's range, fence off towhee habitat, remove invasive plants, and monitor towhee populations (USFWS 2010)." This agreement supports efforts directed towards eventual delisting of the Inyo California towhee and continues the conservation of the species. Map 3-9 illustrates the locations of known Inyo California towhee habitat.

A summary of projects and objectives for each of the alternatives that would potentially affect federally listed wildlife species at NAWS-CL is provided below (Table 3-9).

Table 3-9 Summary of projects and objectives intended for federally listed wildlife species[2] at Naval Air Weapons Station China Lake set forth by the alternatives.

Resource Area	Alternative 1: Implement the Revised INRMP including the WHBMP	No Action Alternative: Retain the 2000 INRMP and Current Horse and Burro Management Strategies
Mohave Tui Chub	Continue to maintain and enhance habitat. Plant non-invasive species, such as bulrush, in Mohave tui chub habitat to prevent cattail reinvasion. Continue water quality monitoring efforts. Continue mark-recapture studies to examine the population's dynamics and distribution. Continue to work with CDFW, USFWS, and other organizations to facilitate establishment of populations in other refugia.	Same as Alternative 1. Potential differences in horse and burro management unlikely to affect Mohave tui chub or its habitat.).

[2] The projects and objectives discussed in the table above are for species for which appreciable management actions are necessary. As outlined in the beginning of the chapter, least Bell's vireo, southwestern willow flycatcher, and western snowy plover are all rare migrants through the region and do not present any specific management challenges.

Resource Area	Alternative 1: Implement the Revised INRMP including the WHBMP	No Action Alternative: Retain the 2000 INRMP and Current Horse and Burro Management Strategies
Mohave Desert Tortoise	Continue monitoring of Mohave Desert Tortoise abundance, distribution, and trends. Implement surveys, avoidance, impact minimization measures, and other elements of the 2013 BO. Ensure compliance and applicability of the current BO. Continue to support monitoring and research on Mohave Desert Tortoise by outside agencies.	Same as Alternative 1. Potential differences in horse and burro management unlikely to affect Mohave desert tortoise or its habitat.
Inyo California Towhee	Continue to conduct surveys and populations assessments in the known range of the towhee. Continue to investigate other potential locations in the North Range for possible use by towhees. Continue habitat protection and enhancements, such as controlling horse and burro numbers and access to riparian areas. Control invasive plants. Consider initiating habitat recovery monitoring in habitat impacted by wildfires.	Same as Alternative 1 except greater possibility that Herd population could still exceed AML.

3.1.4.3.1 Alternative 1

Revised Integrated Natural Resources Management Plan Implementation

Key to the continued recovery of Mohave tui chub is the existence of channels with flowing water; Alternative 1 would continue to promote these characteristics through invasive vegetation removal and the development of a habitat improvement plan. Long-term monitoring of Mohave tui chub and its habitat is vital to the maintenance of the NAWS-CL population. Under Alternative 1, monitoring would take place for water quality, Lark Seep flow rates, and habitat population numbers and characteristics (size, health, age classes). This long-term monitoring would be promoted through the continued support of research on Mohave tui chub on the Station.

All management actions for Mohave tui chub would continue to work towards reclassifying the species as threatened. In order to qualify for this, the population must exist in six separate refugia populations of at least 500 fish. To this end, NAWS-CL would continue to work with the CDFW, USFWS, and other organizations to establish additional refugia populations.

Alternative 1 avoids unnecessary impacts to Mohave Desert Tortoise and its habitat as compatible with mission requirements, and in compliance with the 2013 BO. Continued surveying would provide detailed information about distribution, density, and population health. Compliance with the 2013 BO would ensure that quality habitat is conserved on the Station; operations personnel

conduct a visual sweep to remove any Mohave Desert Tortoise present in target areas, test impact areas or construction work areas prior to initiation of activities; and that the Navy uses adaptive fire management measures to help reduce and contain fires on the Station.

NAWS-CL would continue to employ the guidance of the CMA for the Inyo California towhee under Alternative 1. In order to monitor the population on-Station, NAWS-CL would conduct surveys of all known and potential towhee habitat at least three times every 12 years with these survey results to be provided to all parties to the CMA.

Inyo California towhee habitat at NAWS-CL is critical to the species' continued recovery. Alternative 1 would provide benefits to the Inyo California towhee by continuing to minimize surface-disturbing activities in towhee habitat, to the extent feasible. Towhee habitat would be protected by the fencing of springs, the continued removal of invasive plant species, and the protection of quality upland habitat for nesting and foraging.

The creation of a GIS database of known observations of all federally listed species, NAWS-CL Special Status Species, and Critical Habitat would be a top priority. A database would also be created to track the taxonomic and legal status, distribution, and monitoring methods for all NAWS-CL Special Status Species. The status of species proposed for listing under the federal Endangered Species Act would also be tracked. The Station would stay up to date on all reporting requirements for federally listed species.

Special status wildlife species would benefit from the protection/monitoring of their habitats, the increase in knowledge from population surveys and the continued participation of NAWS-CL in cooperative management efforts with other parties under Alternative 1.

Wild Horse and Burro Management Plan Implementation

Direct impacts associated with wild horse and burro gathers would consist of disturbance of the areas in and immediately around the gather site(s) and holding facilities. The likelihood of these instances having impacts to special status wildlife species resources is low, as locations selected for such activities are chosen to be in areas without high value resources (i.e., roads and previously disturbed areas).

The implementation of the WHBMP, with respect to horse populations, would not have direct effects on the Mohave tui chub or Mohave Desert Tortoise, as the range for wild horse populations does not overlap with either species. However burro populations at the Station do overlap with that of Mohave Desert Tortoise. A decrease in burro numbers would benefit Mohave Desert Tortoise by reducing habitat degradation and the likelihood of trampling and by lowering the competition for food resources.

Conversely, the Inyo California towhee would specifically benefit from the reduction in impacts associated with both lower horse and burro numbers. Wild horses and burros inflict extensive damage to riparian and upland habitat at NAWS-CL, some of which is in Critical Habitat for

Inyo California towhee. A reduction in their numbers would continue to aid in the recovery of Inyo California towhee and their habitat.

There would be beneficial impacts to special status wildlife species at NAWS-CL from implementation of Alternative 1. Therefore, there would be no significant impacts from the implementation of the Revised INRMP including the WHBMP.

3.1.4.3.2 No Action Alternative

Retain the 2000 Integrated Natural Resources Management Plan

With the exception of the benefits specific to the implementation of the WHBMP, the effect of the No Action Alternative on Mohave tui chub, Mohave Desert Tortoise, and Inyo California towhee would largely be the same as that of Alternative 1. Additional effects are described below.

Mohave Desert Tortoise would benefit through the implementation of the No Action Alternative by ensuring NAWS-CL complies with the 2013 BO. The BO issues conservation measures designed to protect the Mohave Desert Tortoise from impacts of military activities on-Station. Surveys would continue to be conducted to further understand the distribution, density, and population health of the Mohave Desert Tortoise at NAWS-CL.

Inyo California towhees would benefit from the continued implementation of the CMA signed in 2010. Continued protection of spring and seep habitat would benefit Inyo California towhee by ensuring adequate habitat exists at NAWS-CL for foraging and breeding.

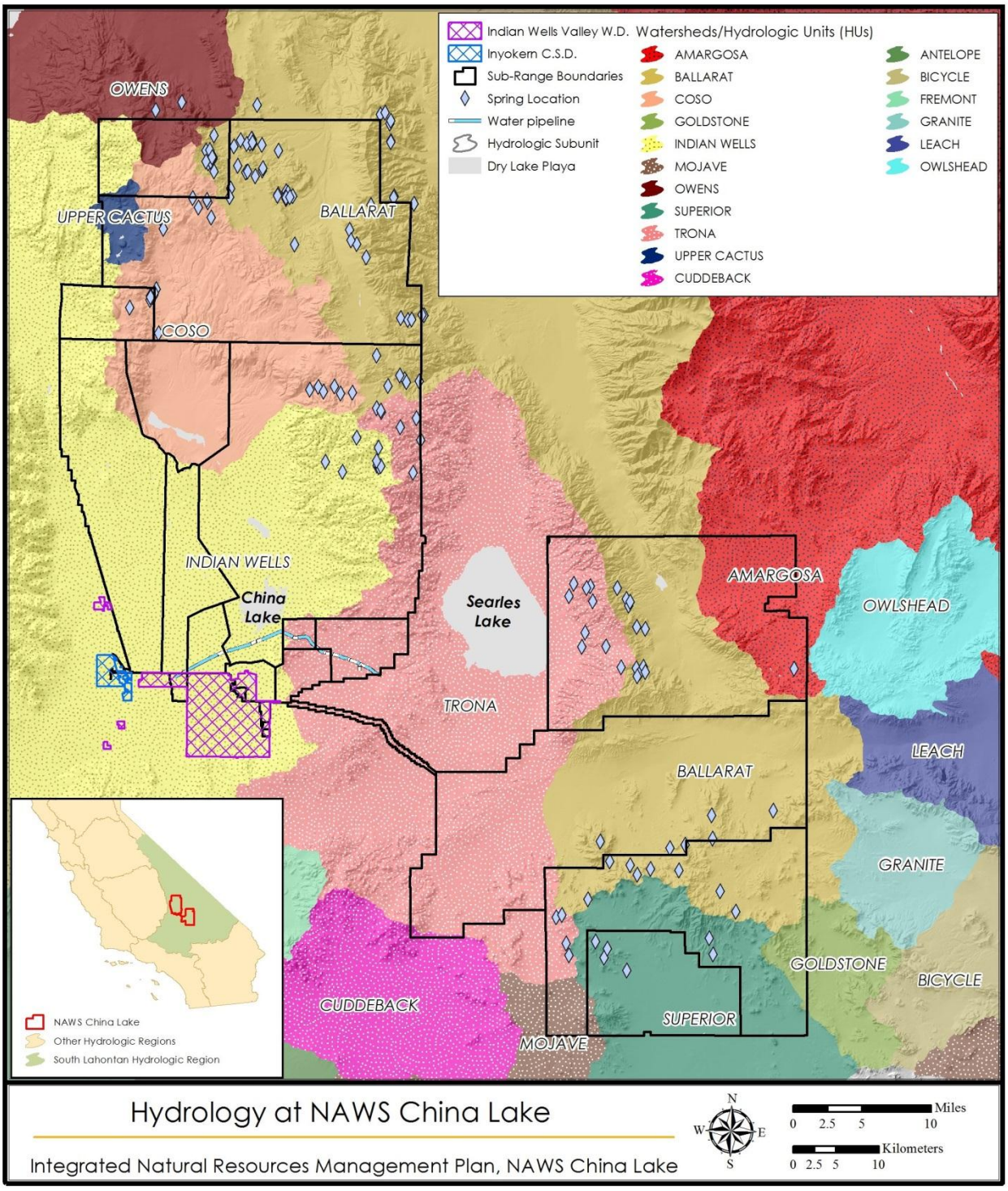
There would be beneficial effects to special status wildlife species at NAWS-CL from implementation of the No Action Alternative.

Current Horse and Burro Management Strategies Implementation

The effects to Mohave tui chub, Mohave Desert Tortoise, and Inyo California towhee from the wild horse and burro management portion of the No-Action Alternative (2000 INRMP) would generally be the same as described for Alternative 1 (Revised INRMP). This is because the 2000 INRMP and the Revised INRMP both have the objective of achieving and maintaining the Centennial Horse Herd to fewer than 168 animals, which is the AML identified in the California Desert Conservation Area Plan. The AML is considered to be the number of horses that NAWS-CL lands can successfully sustain without long term impacts to its natural resources. Both the 2000 INRMP and the Revised INRMP include horse roundups as a management strategy to reduce the numbers of horses, and the only difference between the INRMP versions is that in addition to roundups, the Revised INRMP also provides for the use of other management strategies to reach the AML. Both INRMP versions contain the objective of achieving and maintaining a wild burro population of zero on NAWS-CL. Therefore, implementation of the No-Action Alternative would not result in significant impacts to special status wildlife species.

3.2 Water Resources

NAWS-CL lies within the South Lahontan Basin management area. This area falls under the State Water Resources Control Board Regional Water Quality Control Board Basin Plan (2005). Ten hydrologic units are mapped with portions on the property, but none are completely contained within the boundaries of NAWS-CL (Map 3-10). Within the South Lahontan Basin, surface runoff generally results from rainfall, snowpack melt, or natural springs.



Map 3-10. Watersheds and hydrologic subbasins at Naval Air Weapons Station China Lake. Naval Air Weapons Station China Lake is in the South Lahontan Hydrologic Area for the State Water Resources Control Board.

At NAWS-CL, there are several types of water sources including natural perennial waters, such as springs and seeps that support natural riparian vegetation; natural ephemeral water, such as lake beds (playas), tenajas, and washes; and man-made waters, such as the Waste Water Treatment Facility evaporation ponds and the Lark Seep System. Major playas on the Station are China, Mirror, Satellite, and Airport Lakes, all within the North Range, and Movie Lake in the South Range. In addition, there are as many as 80 smaller playas ranging from less than an acre to hundreds of acres in size.

In the Indian Wells Valley in the North Range, the greatest surface flows occur during and after storm events in the El Paso Mountains and southern Sierra Nevada, and in the Coso and Argus Ranges, as well as the Rademacher Hills (see Map 3-10). These ephemeral flows are then conveyed to the dry basins through local washes. Most runoff in the Indian Wells Valley comes from four major ephemeral streams: the El Paso, Little Dixie, Ridgecrest, and Bowman Washes, as well as other, smaller, ephemeral washes that discharge into China, Satellite, and Mirror Lakes. Runoff channels and arroyos transport surface water flow laterally, but infiltration also takes place.

3.2.1 Springs

In the North Range there are over 80 mapped springs, primarily in the Argus and Coso Ranges. The mapped springs include small areas of moist soil, pools, intermittently flowing streams with riparian vegetation, and an artesian well at Paxton Ranch (no longer flowing [T. Campbell, pers. com. 2013]). Many springs were developed by miners and ranchers prior to the Navy assuming management of the lands. A few springs are maintained by the Navy for remote facility use or for firefighting.

In the South Range there are 42 mapped springs or seeps. There are no naturally occurring ponds or standing water other than ephemeral pools or playas on the South Range, which receives drainage from the Slate Range, Panamint Range, Quail Mountains, Eagle Crags, Brown Mountain, Pilot Knob, Slocum Mountain, Robbers Mountain, and Granite Mountain. A few of the springs may disappear in dry years.

Coso Hot Springs is a series of geothermal-fed springs of hot, non-potable mineral water (See Appendix F of the Revised INRMP). The Navy does not believe ground water pumping impacts the springs as there is no known hydrological connection (Navy 2013c).

3.2.2 Seeps

NAWS-CL has two interconnected seeps located in the southern portion of the North Range. The Lark Seep System consists of a series of seeps and channels which divert water from the Lark Seep area to G-1 Seep. Both Lark Seep and G-1 Seep are brackish marshes formed on the edge of the China Lake Playa.

The Lark Seep System is characterized by naturally high groundwater conditions. The creation of the Waste Water Treatment Facility and resulting percolation of water from its evaporation ponds has forced groundwater movement in this area to the north where it surfaces near Lark Seep,

helping to augment the existing seep's habitat (M. Stoner, pers. com. 2010). Additionally, the Lark Seep System receives additional water from the golf course and nearby Station housing.

During building construction at NAWS-CL in the 1950s for test/range support, a series of channels were constructed to intercept the elevated groundwater and divert it to the G-1 area (away from building sites). The Lark Seep System was created to divert water into Lark Seep and G1 Seep via George, North, and G1 channels. Approximately 2.5 miles of channels continue to carry water out to the G-1 Seep.

Both seep systems include areas of open water and have provided habitat for the introduced and federally endangered Mohave tui chub populations. Recently, the G-1 Seep suffered severe drying and NAWS-CL biologists, with concurrence from USFWS and CDFW, relocated 1,400 chub to areas upstream toward Lark Seep and the North Channel.

Dominant vegetation types in these seeps include cattail marsh, and alkali meadow (Glen Lukos Associates 1998). Minor amounts of groundwater from the golf course and housing areas contribute to the recharge into the Lark Seep area.

3.2.3 Floodplains and Flooding

Average precipitation within the South Lahontan region is low; however, intense cloudbursts may result in occasional flooding. A 1983 flood caused significant damage on the North Range at Main Site, especially in and around the Michelson Laboratory area, so diversion channels were constructed to prevent flooding at Main Site by re-directing surface water to the playa lakes (M. Stoner, pers. com. 2010).

Outlying range areas and the South Range have also been affected by flooding from seasonal runoff, but floods in these areas have caused less damage.

3.2.4 Jurisdictional Waters of the U.S. and Wetlands

All wetlands occurring on federal land are protected under Executive Order 11990 Protection of Wetlands (24 May 1977, as amended). Federal agencies are directed to avoid, to the extent possible, the long-and short-term adverse impacts associated with the destruction or modification of wetlands, and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative. On-Station, some areas such as springs and seeps that function as wetlands ecologically, but exhibit only one or two of the three characteristics (hydrology, soil, or wetland plants) under U.S. Army Corps of Engineers guidelines, do not currently qualify as Clean Water Act jurisdictional wetlands or waters of the U.S.

Recent court decisions have likely eliminated most NAWS-CL drainages and playas from jurisdiction under Section 404 of the Clean Water Act and the need for a 401 Certification. No areas within NAWS-CL have the necessary characteristics of jurisdictional waters or wetlands: none are navigable, none cross state lines, and none are used for interstate commerce.

Portions of drainages that flow into off-Station drainages have been identified by the U.S. Army Corps of Engineers as jurisdictional waters of the U.S. due to the interstate commerce connection. The Owens River and the Mojave River may contribute flows to jurisdictional waters.

3.2.5 Effects on Water Resources

A summary of projects and objectives for each of the alternatives that would potentially affect water resources at NAWS-CL is provided below (Table 3-10).

Table 3-10 Summary of projects and objectives intended for water resources at Naval Air Weapons Station China Lake set forth by the alternatives.

Resource Area	Alternative 1: Implement the Revised INRMP including the WHBMP	No Action Alternative: Retain the 2000 INRMP and Current Horse and Burro Management Strategies
Springs and Seeps	Develop an integrated spring monitoring, enhancement, and adaptive management program. Update and collect additional baseline data, such as water chemistry, flow rates, aerial extent, vegetation, and other parameters. Continue to fence in springs as possible.	Continue to collect baseline data. Continue to fence in springs, as possible.
Floodplains	Assist Navy planners in creating a flood hazard boundary map so that the severity and type of flooding may be predicted, and impacts to floodplains may be avoided. Identify any special or unique flora and fauna associated with floodplains in order to identify the natural and beneficial functions provided by floodplains. Ensure compliance with Chief of Naval Operations Instruction M-5090.1.	Ensure compliance with Chief of Naval Operations Instruction M-5090.1

3.2.5.1 Alternative 1

Revised Integrated Natural Resources Management Plan Implementation

Alternative 1 would provide benefits to springs and seeps by continuing the ongoing protections provided by the Comprehensive Land Use Management Plan (Navy 2005a). The long-term inventory, protection, and enhancement of springs and seeps would help maintain and promote natural plant communities. Removing invasive species, maintaining/installing fences, and monitoring the flow rate both inside and outside the fencing would increase native habitat and quality of native water sources.

Floodplain management would be considered under Alternative 1 through the use of the National Environmental Policy Act and site approval process in compliance with Chief of Naval Operations Instructions 5090.1D. Additionally, new buildings, utilities, or test areas would be constructed away from floodplains, if possible, to reduce the risk of damage during a flood event.

In order to ensure planning activities are fully abridged of floodplain boundaries, the Navy would assist in creating a flood hazard boundary map.

Alternative 1 directs the Navy to verify the presence or absence of jurisdictional waters of the U.S. and to maintain and enhance open waters as a potential rest area for migratory birds.

The extensive monitoring, surveying, and management efforts, coupled with the protection of vital water resources under Alternative 1, would have moderate beneficial effects on water resources.

Wild Horse and Burro Management Plan Implementation

Direct impacts associated with wild horse and burro gathers would consist of disturbance of the areas in and immediately around the gather site(s) and holding facilities. The likelihood of these instances having impacts to water resources is low, as locations selected for such activities are devoid of high value resources and are located on roads or previously disturbed sites.

The implementation of Alternative 1 would help reduce the impact that wild horses and burros have on the vegetation found at water sources on NAWS-CL. This vegetation is essential in continuing the hydrologic function of water resources and helps ensures water retention. Additional damage is inflicted on these sensitive resources through the disturbance of soils in the surrounding areas, the establishment of trails leading to water resources, and through the degradation of water quality due to wild horses and burros fouling the water.

Obtaining an AML would help to substantially reduce impacts to water resources. Therefore, there would be no significant impacts from the implementation of the Revised INRMP including the WHBMP.

3.2.5.2 No Action Alternative

Retain the 2000 Integrated Natural Resources Management Plan

The No Action Alternative would protect water resources by continuing to monitor springs, seeps, and other water sources and their associated vegetation. Floodplains, while not discussed in detail, would be considered under Chief of Naval Operations Instruction 5090.1D CH-12, which states that the Navy would avoid unnecessary development of floodplains. This would benefit new buildings, utilities, or test areas to be constructed in the future as they could avoid flood damage.

Current Horse and Burro Management Strategies Implementation

The effects to water resources (including springs, seeps, lakes/playas, washes, waste water treatment facility ponds, and the Lake Seep System) from the wild horse and burro management portion of the No-Action Alternative (2000 INRMP) would generally be the same as described for Alternative 1 (Revised INRMP). This is because the 2000 INRMP and the Revised INRMP both have the objective of achieving and maintaining the Centennial Horse Herd to fewer than 168 animals, which is the AML identified in the California Desert Conservation Area Plan. The AML is considered to be the number of horses that NAWS-CL lands can successfully sustain

without long term impacts to its natural resources. Both the 2000 INRMP and the Revised INRMP include horse roundups as a management strategy to reduce the numbers of horses, and the only difference between the INRMP versions is that in addition to roundups, the Revised INRMP also provides for the use of other management strategies to reach the AML. Both INRMP versions contain the objective of achieving and maintaining a wild burro population of zero on NAWS-CL. Therefore, implementation of the No-Action Alternative would not result in significant impacts to water resources.

3.3 Topography, Geology, and Soils

3.3.1 Topographical Features

NAWS-CL contains widely varying desert topography dissected by ephemeral washes and terminal playa lakebeds, along with volcanic tablelands and mountain ranges. Elevations range from less than 2,000 feet above mean sea level on the South Range, to over 8,800 feet above mean sea level at Maturango Peak, with an average of 4,347 feet above mean sea level in the Argus Mountains of the North Range. The Coso Range has an average elevation of 6,500 feet above mean sea level, and the Slate Range averages 4,500 feet above mean sea level with Straw Peak the highest at 5,578 feet. The Eagle Crags are at 5,512 feet above mean sea level. Table 3-11 lists key landforms of the North and South Ranges.

Table 3-11 Key landforms of the North and South Ranges at Naval Air Weapons Station China Lake.

North Range	
Volcanic Tablelands and Mountains	Coso Range (includes Coso Peak, Sugarloaf Mountain, Cactus Peak); Argus Ranges (includes Maturango Peak)
Valleys	Northern Indian Wells Valley, Etcheron Valley, portion of Salt Wells Valley
Basins and Playas	Vast expanse of fairly flat desert topography dissected by ephemeral washes and terminal playa lakebeds. China Lake, Mirror Lake, Satellite Lake, Paxton Ranch Playa, Airport Lake, Coso Basin, numerous other unnamed playas
Washes and Canyons	Darwin Wash, Petroglyph Canyon, Renegade Canyon, Mountain Spring Canyon, Wilson Canyon, Burro Canyon
Flats	Coles Flat, Cactus Flats
South Range	
Mountains	Slate Range, Panamint Range, Brown Mountain, Quail Mountains, Granite Mountains, Black Mountain, Robbers Mountain, Black Hills, Slocum Mountain, Eagle Crags, Lava Mountains
Valleys and Playa	Panamint Valley, Pilot Knob Valley, Superior Valley, Long Valley, Searles Valley, Movie Dry Lake
Wash	Wingate Wash

The Indian Wells Valley dominates the low elevations of the North Range. It is bordered on the north by the Coso Range; on the east by the Argus Range and Salt Wells Valley; on the south

(off the Station) by the Rademacher Hills, El Paso Mountains, and Spangler Hills; and on the west by the steep escarpment of the southern Sierra Nevada.

Pilot Knob Valley and Superior Valley are the dominant basins of the South Range. Pilot Knob Valley bisects the South Range; it is bordered on the north by the Slate Range and Quail Mountains; Granite Mountains to the east; on the south by Black Mountain, Robbers Mountain, Black Hills, and Eagle Crags; and to the west the Lava Mountains. Superior Valley is bounded on the north/northwest by Slocum Mountain, Pilot Knob, and Eagle Crags; on the east by Lane Mountain; and on the south by Opal Mountain.

Other unmapped geomorphic features occur at NAWS-CL include bajadas, dunes, and desert pavement.

3.3.2 Geology and Soil

Desert geology and soils are inter-connected features, with geology influencing the types of soil found in a given location. Soils are mapped to the association level at NAWS-CL (INRMP Map 3-6, Table 3-4). Each polygon on the soils map represents several soil series, but the actual boundaries have not been determined. The standard soil map for the area is the 1993 Natural Resources Conservation Service State Soil Geographic Database GIS data layer.

Within the North Range, the predominant soil unit identified is Rosamond-Rosamond Variant-Playas, found on basin floors and playas. This soil association also occurs on the South Range in Superior Valley and Searles Valley.

Further up the slope from the playa areas are soils formed on alluvial plains. These soils have a sandy surface layer in most areas, but the underlying soil varies widely in clay content and layering. Some of these soils contain cemented layers that are referred to as caliche or hardpan (U.S. Soil Conservation Service 1989). The State Soil Geographic database map unit corresponding to this environment within the North Range is Cajon-Wasco-Rosamond, found on alluvial plains.

Soils in the Coso Range typically have a clay accumulation below the surface layer. Loamy or clayey subsoils with a layer of clay accumulation occur on volcanic flows. Mountain valley fan terraces contain deep alluvial soils with sandy surface textures and sandy or loamy subsoils.

Soils in the Indian Wells Valley are mostly sandy with some areas exhibiting stratified soils with variations in clay content. Silica or carbonate cemented soils also occur, representing caliche deposits. Near playas, soils are predominantly silts and clays, exhibiting very low dry densities and high moisture content. Soils in playas range from sand to clays with high salt concentrations.

3.3.3 Effects on Topography, Geology, and Soils

A summary of projects and objectives for each of the alternatives that would potentially affect topography at NAWS-CL is provided below (Table 3-12).

Table 3-12 Summary of projects and objectives intended for topographic, geological, and soil resources at Naval Air Weapons Station China Lake set forth by the alternatives.

Resource Area	Alternative 1: Implement the Revised INRMP including the WHBMP	No Action Alternative: Retain the 2000 INRMP and Current Horse and Burro Management Strategies
Topography	No projects prescribed in the Revised INRMP specifically deal with topography.	Continue to implement the best management practices (minimizing work in windy conditions, watering spoils piles, covering spoils piles overnight, and utilizing straw wattles when appropriate) during ground disturbing activities and comply with local and federal agency dust control measures.
Geology and Soils	Continue to implement best management practices (minimizing work in windy conditions, watering spoils piles, and utilizing straw wattles when appropriate) during ground disturbing activities and comply with local and federal agency dust control measures. Support the development of a Wind and Water Erosion Best Practice Manual. Consider the long-term development of a GIS layer of ecological sites and land management units, incorporating soil data points and field assessments based on federal standards.	

3.3.3.1 Alternative 1

Revised Integrated Natural Resources Management Plan Implementation

Alternative 1 would not directly deal with topography as none of the proposed actions would have impacts on a scale large enough to change the topography at NAWS-CL.

Alternative 1 would minimize impacts to geology and soils through the implementation of Best Management Practices (BMPs) (minimizing work in windy conditions, watering spoils piles, and utilizing straw wattles when appropriate) that follow federal and state guidelines. Appropriately designed and implemented BMPs would aid in reducing site disturbance, controlling erosion, and minimizing dust. Implementation of Alternative 1 would reduce erosion and lower damage to soils and provide moderately beneficial effects to geological and soil resources at NAWS-CL.

Wild Horse and Burro Management Plan Implementation

Direct impacts associated with wild horse and burro gathers would consist of disturbance of the areas in and immediately around the gather site(s) and holding facilities. These gather events take place for a limited amount of time only a few days a year and are carefully selected to be in areas either previously impacted or with minimal resources. Therefore the impact from the temporary gather sites and holding facilities to geology, and soils would be minimal.

The implementation of the WHBMP under Alternative 1 would reduce soil erosion and compaction associated with the movement of hooved animals (outside of the impacts induced by horse gathers). Fewer horses and burros would help to maintain the soil and the geologic

function of native ecosystems as a reduction in their numbers would reduce the damage their movement and foraging has on soils. A reduction in horses and burros across the Station would benefit geology and soils.

There would be beneficial impacts to soil and geological resources at NAWS-CL from implementation of Alternative 1. Therefore, there would be no significant impacts from the implementation of the Revised INRMP including the WHBMP.

3.3.3.2 No Action Alternative

Retain the 2000 Integrated Natural Resources Management Plan

Topography, geology, and soils are not explicitly discussed in the 2000 INRMP. However, geology and soils would continue to benefit from the implementation of BMPs (minimizing work in windy conditions, watering spoils piles, and utilizing straw wattles, when appropriate) in areas of ground disturbance under the No Action Alternative.

Current Horse and Burro Management Strategies Implementation

The effects to topography, geology and soils from the wild horse and burro management portion of the No-Action Alternative (2000 INRMP) would generally be the same as described for Alternative 1 (Revised INRMP). This is because the 2000 INRMP and the Revised INRMP both have the objective of achieving and maintaining the Centennial Horse Herd to fewer than 168 animals, which is the AML identified in the California Desert Conservation Area Plan. The AML is considered to be the number of horses that NAWS-CL lands can successfully sustain without long term impacts to its natural resources. Both the 2000 INRMP and the Revised INRMP include horse roundups as a management strategy to reduce the numbers of horses, and the only difference between the INRMP versions is that in addition to roundups, the Revised INRMP also provides for the use of other management strategies to reach the AML. Both INRMP versions contain the objective of achieving and maintaining a wild burro population of zero on NAWS-CL. Therefore, implementation of the No-Action Alternative would not result in significant impacts to topography, geology and soils.

3.4 Cultural Resources

Cultural resources are those aspects of the physical environment that relate to human culture and connect communities, individuals, and groups of people to their surroundings. Cultural resources may consist of sites, objects, buildings, districts, or structures. Cultural resources include expressions of human culture and society in the physical world. They may be historic or prehistoric. As of November 2011, nearly 6,100 cultural resources (all sites and artifacts) have been recorded at NAWS-CL, and the identification and recordation of additional cultural resources is ongoing (Navy 2013c). For a detailed description of cultural resources, refer to the Integrated Cultural Resource Management Plan (SWCA 2011).

3.4.1 Prehistoric Resources

A wide range of prehistoric site types have been found at NAWS-CL. They include quarries, lithic scatters, ceramic scatters, trails, habitation sites, bedrock millings, rock features, and rock art. As of January 2012, almost 3,600 prehistoric archaeological sites have been recorded at NAWS-CL (Navy 2013c). The Coso Volcanic Field is a well-documented obsidian quarry site. The South Range contains additional prehistoric quarries of metavolcanic, basalt, chert, and chalcedony that were valuable resources to prehistoric peoples.

Temporary habitation sites can be found across the Station in resource-centric areas. While rare, long-term habitation sites have been found at NAWS-CL. Habitation sites contain a wide variety of features and artifacts important to understanding the prehistory of the region. These resources include hearths, rock shelters, projectile points and imported materials. Hearths are particularly important because they contain charcoal that can be used for dating and organic material that can provide data relevant to understanding diets. Rock shelters are also important as they as they offer the best protection from the elements and often preserve organic materials over a long period. To date, five archaeological districts have been listed or recommended as eligible for the National Register of Historic Places—Coso Rock Art District, Coso Hot Springs, Pothunter Spring Archaeological District, Sugarloaf Archaeological District, and Cactus Flat—of which the Coso Rock Art District is also a National Historic Landmark (Navy 2004; SWCA 2011).

3.4.2 Historical Archaeological Resources

Historical archaeological resources at NAWS-CL are generally associated with one or more of five broad categories: military, mining, homesteading/ranching, water development, and/or transportation (SWCA 2011).

Early military expeditions to the area occurred in the 1840s and 1850s, with additional military presence helping to resolve a conflict with Native American groups and Euroamerican settlers in the 1860s. Mining of the area's metals and minerals began within this time frame, with the earliest settlements taking place in the 1860s. Homesteads and ranches were established after commercial operations had begun; remnants of these homesteads still exist throughout the Station. Minining operations, ranches and homesteads were removed from the Station when the Navy took control of the land in the 1940s and most buildings were demolished at this time. The earliest transportation routes in the area were Native American trails later used and expanded by Euroamerican settlers. Historic roads found at NAWS-CL were largely a means of connecting mines with major transportation routes.

3.4.3 Historic Navy-Built Resources

In 1943 the Navy (Naval Ordnance Test Station) began to use Inyokern Airport (Harvey Airfield) as a base of operation for rocket testing. In 1944, with condemnation proceedings completed, construction at the Main Station, Salt Wells, China Lake Propulsion Laboratory, and Armitage Field began. As the small burg of Crumville (later changed to Ridgecrest) did not contain housing sufficient to shelter the workers, sailors and civilian employees' quarters had to

be built. Temporary camps were erected for construction workers near Sandquist Gate and the exterior China Lake Propulsion Laboratory/Salt Wells Gate. Sailors and some civilians were housed in barracks near the headquarters building while senior scientists and higher ranking officers were housed in newly constructed housing near what is now the Ordinance Museum. After WWII, new housing was built for both military and civilian personnel, along with a new open area shopping center and theater. As the only schools in the area existed in the surrounding communities of Inyokern, Randsburg, and Trona, the Station Commander and senior civilians took it upon themselves to petition the State of California for the development of the China Lake School District (Sierra Sands). New schools were built on Navy-managed lands. Funding to build the schools came out of the budgets for the Navy and Atomic Energy Commission.

3.4.4 Native American Resources

The vast area, proximity to natural corridors leading through the surrounding mountain ranges and availability of natural resources at NAWS-CL supported the occupation by prehistoric peoples or groups. The area had a variety of uses to indigenous peoples: travel corridor, permanent and semi-permanent habitation, and/or subsistence gathering. The ethnolinguistic groups using the NAWS-CL area include the Koso (Western Shoshone), the Kawaiisu (a distinct language related to Southern Paiute), the Owens Valley Paiute (Northern Paiute), the Tubatulabal (speakers of a Uto-Aztecan language related to Paiute-Shoshone), and the Chemehuevi (Navy 2013c). With the exception of the Tubatulabal, these are all federally recognized tribes.

Land use by Native American groups varied across groups and time. Multiple groups utilized the lands that are now NAWS-CL as their permanent residence, while others used parts of NAWS-CL for periodic residence or resource exploitation. Groups who saw NAWS-CL as their core area were most likely to live in villages or encampments for a significant part of the year (Navy 2013c).

One area of particular importance to Native American groups in the area is Coso Hot Springs and its associated Prayer Site. It has been documented that Native American groups believe the Coso Hot Springs have healing properties (Navy 2013c). The site is still used today by Native American groups who trace their ancestry back to the area and is listed on the National Register of Historic Places. The Coso Hot Springs have been formally identified by the Native American Heritage Commission and NAWS-CL as a Traditional Cultural Property (Navy 2013c).

While implementation of the updated NAWSCL INRMP would not require consultation under Section 106 of the NHPA (see section 3.4.6.1), the draft INRMP and EA were sent to local tribes on May 2, 2014 for review and comment pursuant to NEPA's public involvement process EA and in light of NAWSCL's on-going coordination with these tribes on issues of potential interest to Native Americans.

3.4.5 Wild Horses and Burros as Cultural Property

Looking at the issue of Herd management at the cultural property level, wild horses and burros are managed as part of the larger landscape of the American West. Congress declared in the Wild Free-Roaming Horses and Burros Act (Public Law 920195 Section 1331) that, "...wild free-roaming horses and burros are living symbols of the historic and pioneer spirit of the West." This Act places such horses and burros under the management and protection of the Secretary of the Interior "as an integral part of the natural systems of the public lands," with a goal of achieving and maintaining "a thriving natural ecological balance." The Navy also recognizes the special values afforded these animals by members of the public. However, although the Act discusses horses and burros as being important in a historical context, it also specifically directs that horses and/or burros are to be removed from public lands whenever an overpopulation exists in order to "achieve appropriate management levels". Through the public involvement for this Environmental Assessment described in Chapter 1, the public is able to provide input in the decision-making process.

3.4.6 Effects to Cultural Resources

A summary of projects and objectives for each of the alternatives that would potentially affect cultural resources at NAWS-CL is provided below (Table 3-13).

3.4.6.1 Alternative 1

Revised Integrated Natural Resources Management 1 Plan Implementation

Biological resources damage associated with over-populations of horses and/or burros is most pronounced at springs and seeps. These same areas also tend to support the highest density and diversity of prehistoric cultural resources (Navy 2013b). As stated earlier in Section 3.2.5 (Water Resources), springs and seeps (and the archeological resources around them) would continue to be protected as the Revised INRMP would install new fencing as well as confirm appropriate placement and assess the condition of existing fencing around these resources. Therefore, there would be moderate beneficial effects to cultural resources from implementation of the Revised INRMP under Alternative 1.

Compliance with Section 106 of the National Historic Preservation Act

Compliance with Section 106 and conformance with the 36 CFR 800 process for the NAWS-CL INRMP is accomplished under the Integrated Cultural Resources Management Plan (ICRMP). The Programmatic Agreement Regarding the Implementation of Integrated Cultural Resources Management Plan at Naval Air Weapons Station China Lake serves to implement the processes contained in the ICRMP. The ICRMP streamlines compliance with Section 106 by authorizing NAWS-CL to define an undertaking's area of potential effect (APE), and to make determinations of effect without further consultation with the California State Preservation Officer and the Advisory Council on Historic Preservation.

In accordance with the ICRMP the Navy's Cultural Resources Management Program has initially determined that publishing of the NAWS-CL INRMP is an undertaking that meets the standard under 36 CFR 800.3(a)(1) for being a type of activity that does not have the potential to cause adverse effects on historic properties. The INRMP represents only an overall plan for resources management and a set of management strategies, and in itself does not have the potential affect historic properties. Accordingly, implementation of the INRMP in itself would trigger no consultation obligation under Section 106. However, implementation of future and emergent specific projects as outlined in the INRMP may require further review by Navy Cultural Resources personnel, and may be subject to Section 106 consultation if required pursuant to the National Historic Preservation Act and the NAWS-CL ICRMP. Such reviews would proceed in accordance with Section 7.5.10 of the ICRMP, which guides determination of effect consistent with 36 CFR 800.4 and 800.5, as required to demonstrate compliance with Section 106 of the National Historic Preservation Act for natural resources operations.

In conclusion, there would be beneficial impacts to cultural resources at NAWS-CL from implementation of Alternative 1. Therefore, there would be no significant impacts from the implementation of the Revised INRMP including the WHBMP.

Table 3-13 Summary of projects and objectives intended for cultural resources at Naval Air Weapons Station China Lake set forth by the alternatives.

Resource Area	***Alternative 1: Implement the Revised INRMP including the WHBMP***	***No Action Alternative: Retain the 2000 INRMP and Current Horse and Burro Management Strategies***
Cultural Resources	*Maintain use of the cultural resource consulting process currently in place at NAWS-CL.* *Projects would continue to identify and evaluate impacts to cultural resources on a project-by-project basis.* *Jointly with the Station Cultural Resources Specialist, the Natural Resources Manager should:* ▪ *Conduct surveys prior to new land disturbance activities.* ▪ *Conduct briefings for personnel (range operations, Public Works Department, customers) working in endangered and sensitive habitat areas, and any cultural areas.* ▪ *Minimize damage to water resources, riparian areas, uplands, and cultural resources through Herd reduction to reach the AML.* *Prior to wild horse gathers, cultural resource staff would survey proposed gather locations in order to ensure no impacts to cultural resources.* *During gather events, an archaeologist would be on-site in order to ensure no new cultural resources are discovered and all sensitive cultural areas are avoided by NAWS-CL staff, their vehicles, and the horses.*	*Same as Alternative 1 .*

Wild Horse and Burro Management Plan Implementation

The horse population is now in excess of 450 individuals (T. Campbell, pers. com. 2013), which is approximately three times the upper limit of the AML. The horse herd, along with feral burros at NAWS-CL, has caused damage to cultural properties through compaction of soils and trailing. Evidence of this type of damage can be found at Bircham, Pink Hill, Mesquite and Indian Springs. There is also evidence that horses and burros have used cleared areas contained within rock rings and rock shelters as dust wallows or to bed down. Evidence of this activity can be found in the Dead End Canyon area and numerous locations throughout the South Range. Previously undisturbed cultural properties could be damaged through the further reduction of vegetation, which could lead to erosion.

The implementation of the WHBMP would provide the Station with a number of strategies which may be implemented to return the herd population to the AML. As the Herd's population is reduced to the AML impacts to cultural properties would also be reduced.

Conservation Measures

Alternative 1 would continue current conservation measure practices in order to avoid impacts to cultural resources during wild horse and burro management activities. Current conservation/avoidance measures attempt to avoid impacts both before and during gather events. Prior to gather events, NAWS-CL cultural resource personnel would survey the proposed run or water traps and staging areas identified by NAWS-CL Environmental Management Division personnel as potential areas for impacts. An archaeologist would be on-site during gather activities to ensure that the proposed gather does not adversely affect culturally sensitive sites.

There would be beneficial impacts to cultural resources at NAWS-CL from implementation of Alternative 1. Therefore, there would be no significant impacts from the implementation of the Revised INRMP including the WHBMP.

3.4.6.2 No Action Alternative

Retain the 2000 Integrated Natural Resources Management Plan

The No Action Alternative would implement the same strategies as Alternative 1 to protect cultural resources through continued fencing projects at the springs and seeps.

Current Horse and Burro Management Strategies Implementation

The effects to cultural resources (including prehistoric resources, historical archaeological resources historic Navy-built resources, Native American Resources, and wild horses and burros as cultural property) from the wild horse and burro management portion of the No-Action Alternative (2000 INRMP) would generally be the same as described for Alternative 1 (Revised INRMP). This is because the 2000 INRMP and the Revised INRMP both have the objective of achieving and maintaining the Centennial Horse Herd to fewer than 168 animals, which is the AML identified in the California Desert Conservation Area Plan. The AML is considered to be

the number of horses that NAWS-CL lands can successfully sustain without long term impacts to its natural resources. Both the 2000 INRMP and the Revised INRMP include horse roundups as a management strategy to reduce the numbers of horses, and the only difference between the INRMP versions is that in addition to roundups, the RevisedINRMP also provides for the use of other management strategies to reach the AML. Both INRMP versions contain the objective of achieving and maintaining a wild burro population of zero on NAWS-CL. Therefore, implementation of the No-Action Alternative would not result in significant impacts to cultural resources.

Conservation Measures

The No Action Alternative would implement the same conservation measures for gather events as are prescribed under Alternative 1.

4.0 Cumulative Impacts Analysis

4.1 Introduction

The cumulative impacts analysis was developed per National Environmental Policy Act (NEPA) objectives, Council on Environmental Quality (CEQ) regulations, and CEQ guidance. CEQ regulations (40 Code of Federal Regulations §§ 1500-1508) provide the implementing procedures for NEPA.

4.1.1 Definition of Cumulative Impacts

Cumulative impacts are defined as the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions (40 CFR 1507).

4.1.2 Geographic Boundaries for Cumulative Impacts Analysis

Geographic boundaries for analysis of cumulative impacts vary for the impacted resources and the extent of their reach. For example, air quality is considered on a basin-wide basis, as defined by the California Air Resource Board, whereas NAWS-CL lands may be the appropriate boundary for certain other resources.

4.2 Potentially Cumulative Projects

Since the Navy's Proposed Action and No Action Alternative both involve potential implementation of a plan, and since the implementation of the plan in each instance would in itself generate almost exclusively beneficial impacts (apart from e.g., de minimis motor vehicle emissions associated with surveying/mapping) which as a practical matter would not add to impacts associated with non-planning projects such as construction or energy development, the Navy is limiting the range of potential cumulative projects for this analysis to other planning-type projects in the vicinity of NAWS-CL.

4.2.1 Comprehensive Land Use Management Plan (CLUMP)

In response to the California Desert Protection Act, the Navy developed a CLUMP as the implementing vehicle for NAWS-CL's existing INRMP, Integrated Cultural Resources Management Plan, and Range Management Plan (RMP). The CLUMP was developed by NAWS-CL in partnership with the BLM. The CLUMP also incorporates an update to the airfield AICUZ report. The CLUMP establishes a planning and management framework to facilitate environmental compliance for natural and cultural resources management, assures no net loss of military mission support capability by defining and controlling compatible land uses on-station, and effectively supports the evolving military mission at NAWS-CL. The CLUMP establishes a formal corporate process for land use management at the NAWS-CL that meets current and evolving military mission requirements and ensures compliance with the California Desert

Protection Act and regulations contained in the Navy's Environmental and Natural Resources Program Manual (OPNAVINST 5090.1D). The CLUMP also provides a strategic planning and management vehicle to support the Navy's military mission for land use and environmental resource management.

4.2.2 Bird/Wildlife Aircraft Strike Hazard Plan

Bird/Wildlife Aircraft Strike Hazard (BASH) plans are required by the DoD for military installations where there is a potential for conflict between military activity and wildlife at airfields. BASH plans contain installation-specific information and guidelines to minimize collisions between aircraft and birds or other animals.

In September 2002, NAWS-CL developed and formally implemented a BASH plan for air operations. The plan is implemented through Naval Air Weapons Instruction 3750.2. Designed to reduce the potential for collision between aircraft and birds and other animals, the BASH plan established a Bird Hazard Working Group to monitor and implement the BASH program.

The BASH Avian Use Survey Report (2007) outlined procedures to reduce known and potential bird hazards on and around NAWS-CL. The report identified high hazard situations and areas, to aid air crews in altering flight operations when warranted by avian use survey findings. The BASH Plan minimizes potential collisions between aircraft and birds through careful aerodrome land management practices and analyses of bird migrations within low-level aircraft operating areas (Epsilon Systems Solutions, Inc. 2007).

4.2.3 Integrated Pest Management Plan

The NAWS-CL Integrated Pest Management Plan puts pesticide management within the framework of the DoD and Navy Environmental Management System (EMS) (See Section 1.9 of the Revised INRMP). The Integrated Pest Management Plan provides the tools and products to include pesticide management in the installation's overall EMS program. An environmental impact log is used to identify the practices to be managed in an EMS. Personnel responsible for the practice, specific aspects of each practice, and the impacts on installation vulnerable assets (such as natural resources), are also identified for each practice.

4.2.4 State Comprehensive Wildlife Plan

The State of California’s 2007 Comprehensive Wildlife Plan (CWAP) has a section that pertains to NAWS-CL. The Mojave Desert section of the CWAP recommends region-specific conservation actions, including:

a. Improve stewardship on federally managed lands to protect wildlife diversity.

b. Stabilize groundwater levels and recharge depleted sub-basins of the Mojave River Basin to restore groundwater to levels that support riparian habitat.

c. Stabilize groundwater levels and secure wet habitats in the Amargosa River Basin (this action would help protect the endangered Amargosa vole and the Amargosa pupfish, along with other species).

d. Provide maximum federal and state protection for remaining riparian, spring, seep, and wetland habitats, and restore degraded riparian, spring, seep, and wetland areas.

e. The Bureau of Land Management should improve, and, upon approval, implement the West Mojave Plan. The improvements would include conservation measures to protect all special status species and to maintain wildlife diversity.

f. Reduce off-road vehicle damage to wildlife habitats.

g. Federal, state, and local agencies should put greater resources towards the effort to eradicate or control existing occurrences of invasive species and to prevent new introductions of these species.

h. Fully implement the recovery plans for the Mohave tui chub, Amargosa vole, and Inyo California towhee.

i. California Department of Fish and Wildlife, BLM, and the three military bases that support the Mohave ground squirrel should develop a collaborative conservation and recovery strategy for the Mohave ground squirrel so that federal listing is not necessary.

4.2.5 Recovery Plans for Listed Species

Species-specific recovery plans have been developed for federally listed species known to inhabit the installation. These plans call for the protection and management of known federally listed species habitat in a manner that moves the species toward down-listing or de-listing.

4.2.6 City of Ridgecrest 2010 General Plan

The City of Ridgecrest has direct land use jurisdiction over the incorporated city limits, which encompasses about 21.4 square miles. No specific development projects are identified in the City of Ridgecrest General Plan; however, the General Plan is designed to serve as the jurisdiction's constitution or blueprint for future decisions concerning land use, infrastructure, public services, and resource conservation. It also incorporates a military sustainability element to reflect the specific needs of the community. This element identifies the goals, policies, and implementation measures needed to ensure the city's dual objective of achieving growth while protecting the flight corridors and military missions associated with NAWS-CL. A NAWS-CL Overlay has been defined for the General Plan Land Use Diagram based on noise and safety guidance from the current NAWS-CL Air Installation Compatible Use Zone (AICUZ) study and other compatibility factors. Per the General Plan, within the NAWS-CL Overlay, land use density/intensity is to remain low and in keeping with the land use compatibility guidance contained in the current AICUZ study. Unless already permitted as part of an existing development or approval, only the following land use designations are used on the city's Land Use Diagram: Rural Residential, Low-Intensity Commercial, and Industrial (per Navy AICUZ land use compatibility recommendations and Federal Aviation Administration Part 77

compliance); Public/Quasi-Public; Primarily Designed to House Infrastructure Systems; and Open Space.

4.3 Potential Cumulative Impacts by Environmental Resource Area

4.3.1 Greenhouse Gases and Climate Change

A small amount of greenhouse gas (GHG) emissions would result from implementation of Alternatives 1 and 2 and they would primarily be from the use of motorized vehicles associated with surveying, monitoring, mapping, and restoration/enhancement activities. A small amount of GHG emissions would also result from implementation of the potentially cumulative projects and would primarily be from the use of small equipment at sites undergoing restoration and from the use of motorized vehicles associated with the movement of personnel to, from, and around project sites. All of these GHG emissions would be minor and short-term.

The potential effects of GHG emissions are, by nature, global and cumulative, as most individual sources of GHG emissions are not large enough to have an appreciable effect on global climate change. Therefore, an appreciable impact on global climate change would only occur when GHG emissions associated with the alternatives are combined with GHG emissions from other man-made activities on a global scale. The effects from either alternative, when added to the effects from the cumulative projects, are minor and not large enough to have an appreciable effect on GHGs and global climate change. Therefore, there would be no significant cumulative impacts to GHGs and global climate change from either alternative.

4.3.2 Biological Resources

Implementation of Alternatives 1 and 2 would result in beneficial impacts to biological resources by restoring and/or preserving native habitats, controlling invasive species and providing for the protection of federally listed species.

The potentially cumulative projects are currently providing, and will continue to provide, benefits to area biological resources. The CLUMP includes a process for examining land use on a Station-wide basis and entails improving habitat understanding and wildlife habitat conservation and protection through the use of avoidance measures and education. The BASH Plan aims to reduce aircraft collision damages to wildlife. In considering overlapping resources with NAWS-CL, the CWAP recommends that federal, state, and local agencies: provide greater resources towards the eradication or control of existing occurrences of invasive species and to prevent new introductions of these species; fully implement the recovery plans for the Mohave tui chub and Inyo California towhee; and, develop a collaborative conservation and recovery strategy for the Mohave ground squirrel so that federal listing is not necessary.

Therefore, when added to the impacts from other potentially cumulative projects, Alternative 1 and the No Action Alternative would not result in significant cumulative impacts to biological resources.

4.3.3 Water Resources

Implementation of Alternatives 1 and 2 would result in beneficial effects to water and hydrological resources. For example, the riparian areas would be protected through the maintenance and installation of fencing to exclude wild horses and burros from these areas. Also, springs, seeps and other water sources and their associated vegetation would be monitored and baseline information about these resources collected. The Navy would also avoid development in the floodplains.

The potentially cumulative projects are currently providing, and will continue to provide, benefits to water and hydrologic resources. The CLUMP identifies objectives to protect and restore groundwater, seeps and springs. The Mohave Tui Chub Recovery Plan contains inventory and monitoring techniques and determined the minimum water levels, and water quality standards needed for the survival of the chub. The Inyo California Towhee Recovery Plan contains actions for the protection and enhancement of riparian, springs and seeps.

Therefore, when added to the impacts from the potentially cumulative projects, Alternative 1 and the No Action Alternative would not result in significant cumulative impacts to water resources.

4.3.4 Topography, Geology, and Soils

Implementation of Alternatives 1 and 2 would result in beneficial effects to geology and soils. All projects on NAWS-CL with the potential to produce soil erosion would be conducted in compliance with best management practices that would minimize effects to geological and soil resources. Also, both alternatives would result in reduced impacts to soil and geological resources from wild horses and burros because the numbers of animals would be reduced.

Geology and soils management objectives for NAWS-CL under Alternatives 1 and 2 would be consistent with other existing plans for the Station and region, including the CLUMP and the CWAP. Implementation of the CLUMP would serve to minimize impacts to geology and soils, resulting in a beneficial effect. The CWAP seeks to reduce impacts to soil resources from improper off-road vehicle use and other activities. The City of Ridgecrest General Plan supports low levels of land use activities near NAWS-CL, primarily focusing on infrastructure systems and open space. This would minimize potential impacts to geology and soils in the vicinity of the Station.

Therefore, when added to the impacts from the potentially cumulative projects, Alternative 1 and the No Action Alternative would not result in significant cumulative impacts to geology and soil resources.

4.3.5 Cultural Resources

Alternatives 1 and 2 would afford protection to cultural resources near springs or seeps with the fencing of water resources to prevent damage from wild horses and burros. As a standard operating procedure (conservation measure), an archeologist would be present during wild horse

gather activities under either alternative to ensure avoidance of impacts to culturally sensitive sites.

The CLUMP establishes a planning and management framework to facilitate environmental compliance for natural and cultural resources management. The CLUMP also incorporates established standard procedures for the avoidance and minimization of impacts to environmental resources. The City of Ridgecrest General Plan only supports low levels of land use near NAWS-CL. These would support the Station's mission to minimize potential impacts to cultural resources from development.

Therefore, when added to the impacts from potentially cumulative projects, Alternative 1 and the No Action Alternative would not result in significant cumulative impacts to cultural resources.

5.0 Other NEPA Considerations

5.1 Possible Conflicts between the Alternatives and the Objectives of Federal, Regional, State, and Local Plans

Implementation of the alternatives would comply with existing federal regulations and state, regional, and local policies and programs, while maintaining the military mission. Relevant federal regulations to the alternatives are listed in Chapter 1; compliance with any additional regulations, established during the course of implementation of any of the alternatives, would also occur as necessary.

5.2 Irreversible and Irretrievable Commitment of Resources

Resources that are considered irreversibly and irretrievably committed to a project are those that are used on a long-term or permanent basis. This includes non-renewable natural and human resources, such as labor, petroleum and metals, and cultural resources. If a resource could have been used for other purposes, it is considered irretrievable. The unavoidable destruction of natural resources that could limit the range of potential current and future uses of the site also falls into this category. Examples of irreversible commitments include mining and harvesting old growth forest products.

Implementation of all of the alternatives would involve the consumption of resources for land management, restoration, and land maintenance activities. Implementation of all alternatives would require fuel, chemical products in the form of herbicides and pesticides, and human labor; however, the commitment would be short-term and amounts would be not substantial.

5.3 Energy Requirements and Conservation Potential of Various Alternatives and Mitigation Measures Being Considered

Consumption of energy for routine maintenance, restoration projects, and conservation activities would be minimal and temporary in implementing the alternatives. Mitigation measures would not be required for implementation of the alternatives; however, Alternative 1 does include the establishment of mitigation conceptual goals, which would direct mitigation decisions. Consequently, there is not anticipated to be energy conservation potential and mitigation measures for implementation of any of the alternatives.

5.4 Relationship between Short-Term Uses of the Environment and Long-Term Productivity

The National Environmental Policy Act requires an analysis of the relationship between a project's short-term impacts to the environment and the effects that these impacts may have on the maintenance and enhancement of the long-term productivity of the affected environment.

Impacts that limit the range of beneficial uses of the environment are of particular concern. This refers to the possibility that choosing a single development option reduces future flexibility in pursuing other options, or that giving over a parcel of land or other resource to a certain use essentially eliminates the possibility of other uses considered at that site.

The implementation of either of the alternatives affects both short-term and long-term uses of the environment. The alternatives' effects would be beneficial to natural resources, directed toward enhancing the long-term productivity of the environment through conservation and restoration. Most of the long-term effects would involve the increase in productivity of the environment concerning natural resource functions and the use would be considered temporary, given that the resources could be converted to provide a different function if needed.

5.5 Any Probable Adverse Environmental Effects That Cannot Be Avoided and Are Not Amenable to Mitigation

Implementation of Alternative 1 and the No Action Alternative would not be anticipated to generate adverse environmental effects that are unavoidable or not amenable to mitigation.

6.0 List of Agencies Contacted

Bureau of Land Management
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Field Manager

California Department of Fish and Wildlife
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Appendix A: Implementation Summary Table for the NAWS-CL INRMP

EPR Number	INRMP Section	Class Level	Objective/Project or Activity	Legal Driver	Implementation Year			Measure of Success or Desired Future Condition
					Recurring	2013-2018	2019-2024	
	1.8.1 Ecosystem Management	3	Implement a coordinated monitoring program using land health and focal species indicators that can: – be implemented cost-effectively over time; – facilitate reporting on natural resources condition in relation to other Mojave Desert areas; and – answer annual INRMP program metrics questions. – Set habitat objectives based on ecological sites, ecosystem function indicators, and the requirements of focus species and that can be scaled up to the work of other agencies. Map subregions for natural resources management, data summary, effects analysis, and reporting. Subregions should be based on areas with relatively uniform military use and/or ecological subregions.	Sikes Act, EO 13186, EO 13112, DoD guidance on ecosystem approach; DoD Interagency MOU on federal data standards; Navy guidance on annual INRMP program metrics.	Recurring			Implement ecosystem integrity measures. Continue to facilitate effective partnerships among private, local, state, tribal, and federal interests. Maintain disturbance regimes, hydrological processes, and nutrient cycles, to the extent practicable. Manage and monitor resources over sufficiently long time periods to allow for adaptive management and assessment.
689371236D 689371235C 689371235A	3.3.4 Water Resources, Water Quality, Sediment Quality	4	Develop an integrated spring monitoring, enhancement, and adaptive management plan. Update and collect additional baseline data, such as water chemistry, flow rates, aerial extent, vegetation and other parameters.	ESA, EOs, Migratory Birds, Invasive Species requirements				Biologically or geographically significant or sensitive natural resources are monitored and managed for long-term sustainability. Policy, procedures, and program objectives are prioritized to prevent listing and minimize impacts to military readiness.
	3.3.4.3 Floodplains and Flooding	2	Assist Navy planners in creating a flood hazard boundary map so that the severity and type of flooding may be predicted, and impacts to floodplains may be avoided. Identify any special or unique flora and fauna associated with floodplains in order to identify the natural and beneficial functions provided by floodplains.	EO 11988				Floodplains are mapped and impacts to them are, therefore, avoided and minimized as practicable.

EPR Number	INRMP Section	Class Level	Objective/Project or Activity	Legal Driver	Implementation Year			Measure of Success or Desired Future Condition
					Recurring	2013-2018	2019-2024	
	3.3.5 Jurisdictional Waters of the U.S.	3	Continue to assess the applicability of Section 404 of the CWA as it may apply to the jurisdictional status of all water features on NAWS-CL.	CWA				Complete a review of applicable regulations. Develop maps of impact areas that may require avoidance and minimization measures, if required.
689371236D 689371235C 689371235A 6893720127 68937B0109	3.5 Plant, Fish and Wildlife Populations	4	Continue to conduct baseline inventories and develop maps of high value habitats of to management focus species. Continue resource avoidance, minimization, and conservation measures, and reduce potential of conflict with the military mission.	Sikes Act, DoD Partnership				Ensure that best available scientific information is used in decision-making and adaptive management techniques for natural resource management. Biologically or geographically significant or sensitive natural resources are monitored and managed for long-term sustainability.
68937B0109	3.5 Plant, Fish and Wildlife Populations	4	Continue to encourage research partnerships with other agencies, organizations, and researchers to refine baseline data on the plants and animals at NAWS-CL.	Sikes Act, DoD Partnership				Ensure that best available scientific information is used in decision-making and adaptive management techniques for natural resource management.
68937B0109	3.5.2 Special Status Plant Species	4	Continue to conduct rare plant inventories priority/likely areas. Prioritize searches based on habitat suitability, threats and vulnerabilities, potential for locating endemics, and under-represented areas, as practicable.	Sikes Act, ESA				Biologically or geographically significant or sensitive natural resources are monitored and managed for long-term sustainability. Policy, procedures, and program objectives for the management of NAWS-CL Special Status Species and SAR are prioritized to prevent listing and minimize impacts to military readiness.
	4.3 Soil Resources	3	Continue to implement the best management practices and comply with local and federal agency dust control measures. Support the development of a Wind and Water Erosion Best Practice Manual.	Sikes Act, CAA, CWA				Fugitive dust control measures and implemented in compliance with local and federal requirement Soil conservation is implemented as required. Ecosystem integrity is maintained in direct support of the military mission.

EPR Number	INRMP Section	Class Level	Objective/Project or Activity	Legal Driver	Implementation Year			Measure of Success or Desired Future Condition
					Recurring	2013-2018	2019-2024	
	4.3 Soil Resources	3		Consider the long-term development of a GIS layer of ecological sites and land management units incorporating soil data points and field assessments based on federal standards.	Sikes Act, EO 13186, EO 13112, DoD guidance on ecosystem approach. DoD Interagency MOU on federal data standards.			INRMP metrics may be compared to other installations. Reasonably non-recoverable soil impacts are avoided or minimized. Compliance with applicable soil conservation requirements is maintained.
	4.4 Wildland Fire Management	3	Continue to work with Station and regional fire officials to identify high-value resource areas, assess fire danger, track fire patterns, and assist with maintenance of mutual support agreements. Assess burn area recovery and the need for rehabilitation in these areas as practicable. Assist with the development and implementation of a wildland fire response plan.	Sikes Act, MBTA-Migratory Bird Rule, CDPA, DoDI 6055.6, EO 13514				Restore or rehabilitate altered or degraded landscapes and associated habitats. Promote ecosystem and land sustainability, when practicable and in concert with mission requirements. Natural resources are monitored and managed for their long-term sustainability. Policy, procedures, and program objectives for the management of NAWS-CL Special Status Species and SAR are prioritized to prevent listing and minimize impacts to military readiness.
689371236D	4.5 Vegetation and Habitats	4	Improve the classification of vegetation alliances over time, based on standards adopted by Federal Geographic Data Committee and used by the Mojave Desert Ecosystem Program (Thomas et al. 2004), and already implemented in 1996-1997 at NAWS-CL (Silverman 1997).	Interagency MOU on federal geospatial standards, Sikes Act				Biologically or geographically significant or sensitive natural resources are identified, monitored and managed for long-term sustainability. High risk resources are prioritized to prevent listing and minimize impacts to military readiness.

EPR Number	INRMP Section	Class Level	Objective/Project or Activity	Legal Driver	Implementation Year			Measure of Success or Desired Future Condition
					Recurring	2013-2018	2019-2024	
689371236D	4.5 Vegetation and Habitats	4	Update the Range Assessment Program to answer more specific questions about grazing impacts, land health, and recovery from disturbance. Expand work to include additional key habitats. Consider restoring perennial grasses and perennial forbs appropriate for sites to enhance site stability and wildlife habitat, and that are likely to have been impacted by grazing, as practicable.	Sikes Act, ESA, EO 13186, 13514				Restore or rehabilitate altered or degraded landscapes as practicable. Promote native ecosystems and land sustainability as practicable. Ensure these practices do not conflict with military mission or capabilities. High risk resources are prioritized to prevent listing and minimize impacts to military readiness.
689371236D 68937B0102 689371236E 689371235A 6893720125	4.5 Vegetation and Habitats	4	Develop a long-term program for riparian, wetland, seep, and spring protection, restoration and enhancement. Reduce burro and horse numbers as necessary to avoid or minimize detrimental effects on riparian and other sensitive habitats for wildlife. Consistent with the CDPA Plan, support restoration of unusual plant assemblages including areas classified as wetland riparian.	CDPA, Sikes Act, EO 11990, EO 13186, California Wildlife Action Plan, DoD MOU on Ecosystem Approach (partnerships)				Biologically or geographically significant or sensitive natural resources are monitored and managed for long-term sustainability. High risk resources are prioritized to prevent listing and minimize impacts to military readiness. Continue implementation of programs to protect high value habitats, sensitive and protected species.
68937B0105	4.6.1 Critical Habitat Designation	4	Continue to survey and assess all unoccupied but suitable habitat for the Inyo California towhee.	ESA, NDRA 2004				Contribute to protection and recovery of listed species. Continue long-term monitoring efforts.
68937B0109	4.6.1 Critical Habitat Designation	4	Monitor condition of habitat that supports, or could support, the three listed species and Lane Mountain milk-vetch through a habitat assessment program.	ESA, Sikes Act				Contribute to protection and recovery of listed species. High risk resources are prioritized to prevent listing and minimize impacts to military readiness.
689371235A 6893701211 68937B0101	4.7.3 Invasive Species	4	Continue to monitor for invasive species, document status and new occurrences. Continue control efforts and monitor effectiveness of removal efforts.	ESA, Sikes Act, EO 13112				Identify new occurrences, treat, and monitor control effectiveness over time. Maintain/increase funding levels to adequately address invasive species threats.

EPR Number	INRMP Section	Class Level	Objective/Project or Activity	Legal Driver	Implementation Year			Measure of Success or Desired Future Condition
					Recurring	2013-2018	2019-2024	
	4.7.4 Invertebrates	2	Continue to support invertebrate studies through cooperative agreements, contracts and other means.	Sikes Act				Biologically or geographically significant or sensitive species are monitored and managed for long-term sustainability. High risk species and habitats are prioritized to prevent listing and minimize impacts to military readiness.
	4.7.5 Amphibians and Reptiles	3	Consider using the California Gap Analysis Program (CA-GAP) as a model.	Sikes Act, PARC				Significant or sensitive amphibians and reptiles are monitored and managed for long-term sustainability. High risk species are prioritized to prevent listing and minimize impacts to military readiness.
	4.7.5 Amphibians and Reptiles		Conduct surveys to determine the status and distribution of chuckwalla, Panamint alligator lizard, Gilbert's skink, red spotted toad, slender salamander, and other NAWS-CL Special Status reptiles and amphibians.	Sikes Act, PARC				Continue to conduct surveys and implement monitoring and management techniques for biologically or geographically significant or sensitive species. To the extent practicable ensure long-term sustainability of species and habitats. High risk species are prioritized to prevent listing and minimize impacts to military readiness.
	4.7.5 Amphibians and Reptiles	3	Extirpate non-native amphibians from water sources, such as bullfrogs from the North channel of Lark Seep.	NAIS, Sikes Act, PARC				Implement bullfrog and other invasive species control procedures.
	4.7.5 Amphibians and Reptiles	3	Participate in DoD Partnership on Herptile Conservation (DoD PARC).	Sikes Act, PARC				Actively participate in DoD PARC. High risk species are prioritized to prevent listing and minimize impacts to military readiness.

EPR Number	INRMP Section	Class Level	Objective/Project or Activity	Legal Driver	Implementation Year			Measure of Success or Desired Future Condition
					Recurring	2013-2018	2019-2024	
6893720127	4.7.6 Birds	4	Establish a program to track implementation of the MBTA Readiness Waiver Establish a monitoring program to assess baseline bird population levels to facilitate the assessment of effects of range testing operations. Implement annual reporting of migratory bird impacts from range operations if necessary Continue to develop and refine surveying techniques and minimization and mitigation measures.	MBTA-Migratory Bird Rule				Implement procedural provisions to support application of the Readiness Waiver to the MBTA. Conduct bird surveys in target areas and in representative habitat types to assess impacts to bird species at a population level. Design impact avoidance and mitigations measures to minimize impacts to affected species. Conduct efforts in concert with NAWC-WD to support compliance and mission accomplishment.
6893720127	4.7.6 Birds	4	Continue to develop and enhance baseline data on presence, activity, and use areas for migratory birds. Incorporate monitoring and reporting requirements from the Raven MOU if applicable.	Sikes Act, MBTA, EO 13186, MBTA-Migratory Bird Rule				Assess impacts to MBTA protected species. Manage resources to facilitate for long-term sustainability. High risk species are prioritized to prevent listing and minimize impacts to military readiness.
	4.7.6 Birds	3	Develop a habitat protection, enhancement and management program for management focus species building on habitat value and use area maps for birds. Consider enhanced management efforts at the wastewater treatment ponds.	MBTA-Migratory Bird Rule, EO 13186				High risk species are prioritized to prevent listing and minimize impacts to military readiness. Prioritize policies, procedures, and program objectives for the management of species to prevent listing and protect species to minimize impacts military readiness.
68937B0102 689371236E 68937B0105	4.7.6 Birds	4	Continue to implement the NAWS-USFWS Inyo California towhee MOA intended to facilitate delisting of this species.	ESA				Ensure compliance with provisions of the existing BO and fully implement management actions required by the MOA. Monitor population status to contribute to the eventual de-listing of this species and support mission accomplishment.

EPR Number	INRMP Section	Class Level	Objective/Project or Activity	Legal Driver	Implementation Year			Measure of Success or Desired Future Condition
					Recurring	2013-2018	2019-2024	
	4.7.6 Birds	2	Continue to work with other wildlife management agencies on bird census, survey, trapping, banding, and translocation efforts.	Sikes Act, EO 13186				Biologically or geographically significant or sensitive natural resources are monitored and managed for long-term sustainability. Research efforts are supported to the extent practicable.
	4.7.7 Mammals	3	Conduct genetic and taxonomic studies on the vole and shrew populations. Consider conducting additional surveys to determine the range of these animals.	Sikes Act				Species distributions are better defined and taxonomic studies continue to be supported. Known and potential habitats continue to be protected to extent practicable and managed for their long-term sustainability. Data is provided to and research coordinated with regional land managers to facilitate range-wide management and to prevent listing and minimize impacts to military readiness.
	4.7.7 Mammals	3	Consider installation of bat gates at mines utilized as roost or maternity colonies of Townsend's big-eared bats, including Redwing mine, lower Star of the West mine, and Josephine mine.	Sikes Act				Biologically or geographically significant or sensitive bat species are monitored and managed for long-term sustainability. Data is provided to and research coordinated with regional land managers to facilitate range-wide management and to prevent listing and minimize impacts to military readiness.
68937B0126	4.7.7 Mammals	4	Continue to monitor the status of bighorn sheep and other NAWS-CL Special Status Species.	Sikes Act, NPS Cooperative Agreement				Bighorn sheep are monitored and managed for long-term sustainability. Data is provided to and research coordinated with regional land managers to facilitate range-wide management and to prevent listing and minimize impacts to military readiness.

EPR Number	INRMP Section	Class Level	Objective/Project or Activity	Legal Driver	Implementation Year			Measure of Success or Desired Future Condition
					Recurring	2013-2018	2019-2024	
	4.7.7 Mammals	3	Conduct additional mammal surveys and assessments as needed. Continue to support research requests from outside agencies and organizations.	Sikes Act				Species distributions are better defined and taxonomic studies continue to be supported. Known and potential habitats continue to be protected to extent practicable and managed for their long-term sustainability. Data is provided to and research coordinated with regional land managers to facilitate range-wide management and to prevent listing and minimize impacts to military readiness.
68937B0102 6893720121	4.7.7.1 Wild Horses and Burros	4	Continue implementation of wild horse and burro management efforts. Implement enhanced management techniques defined in this INRMP.	ESA				Horse and burro numbers are maintained at AML.
68937B0096	4.8.1.1 Mohave Tui Chub	4	Continue to maintain and enhance habitat. Plant non-invasive species, such as bulrush, in Mohave tui chub habitat to prevent cattail reinvasion. Continue water quality monitoring efforts	ESA				Chub habitat remains in a properly managed condition. Invasive species are controlled and water quality standards are maintained.
68937B0096	4.8.1.1 Mohave Tui Chub	4	Continue mark-recapture studies to examine population dynamics and distribution.	ESA				Ensure population levels continue to be assessed and that numbers remain within reasonable levels.
68937B0096	4.8.1.1 Mohave Tui Chub	4	Continue to work with CDFW, USFWS, and other organizations to facilitate establishment of populations in other refugia.	ESA				Efforts to establish other populations and refugia are actively supported. Efforts designed to eventually delist this species are actively supported.
6893718537	4.8.1.2 Desert Tortoise	4	Continue monitoring of desert tortoise abundance, distribution and trends. Implement surveys, avoidance, impact minimization measures and other elements of the current BO.	ESA, Sikes Act				Compliance with provisions of the current BO is maintained.
	4.8.1.2 Desert Tortoise	2	Continue to support monitoring and research on desert tortoise by outside agencies.					Continue to support ongoing research and survey efforts by outside agencies and organizations. Support species recovery efforts to the extent practicable.

EPR Number	INRMP Section	Class Level	Objective/Project or Activity	Legal Driver	Implementation Year			Measure of Success or Desired Future Condition
					Recurring	2013-2018	2019-2024	
68937B0105	4.8.1.3 Inyo California Towhee	4	Continue to conduct surveys and population assessments in the known range of the towhee. Continue to investigate other potential locations in the North Range for possible use by towhees.	ESA, DoD Partnership				Compliance with BO and contributions to recovery and de-listing of species is maintained
68937B0102 689371236E	4.8.1.3 Inyo California Towhee	4	Continue habitat protection and enhancements, such as controlling horse and burro numbers and access to riparian areas. Control invasive plants. Consider initiating habitat recovery monitoring in habitat impacted by wildfires.	ESA, EO 13186				Provisions of MOA with USFWS are implemented.
	4.8.1.4 Mohave Ground Squirrel	3	Continue to support ongoing efforts to study and monitor the Mohave ground squirrel.	Sikes Act, DoDI 4715.03				Conservation of state-listed species is implemented as practicable, and does not conflict with legal authority, the military mission, or operational capabilities. Policy, procedures, and program objectives for the management of state-listed species are prioritized to prevent listing and minimize impacts to military readiness.
	5.2 Adapting to Regional Growth and Climate Change	1	Monitor emerging research and assess potential implications to NAWS-CL.	Sikes Act, DoDI 4715.03				Consider the effects of climate change to natural resources. Implement management changes as appropriate.
	5.3 Animal Damage Control	2	Comply with the MBTA and obtain depredation permits for control of bird problems as warranted. Consider expanding the permits to cover other installation facilities.	MBTA				Safe and efficient procedures for preventing and controlling animal pests that affect human health and safety and to avoid negative impacts to native wildlife and habitats are implemented Compliance with USFWS depredation permit (50 CFR 21.41) is maintained.
	5.3.1 Bird/Wildlife Aircraft Strike Hazard Prevention	3	Support BASH Program in concert with Airfield Operations. Implement recommendations from the avian use survey as appropriate.	Navy Mission, Sikes Act, NAWSINST 3750.2				Bird hazards are controlled, reducing bird/wildlife aircraft strike hazards.
	5.3.1 Bird/Wildlife Aircraft Strike Hazard Prevention	2	Continue to share data with the Los Angeles Department of Water and Power (LADWP) Owens Lake Re-watering program. Monitor high seasonal bird use areas as needed.	Navy Mission, Sikes Act, NAWSINST 3750.2				Bird/wildlife aircraft strike hazards are reduced.

EPR Number	INRMP Section	Class Level	Objective/Project or Activity	Legal Driver	Implementation Year			Measure of Success or Desired Future Condition
					Recurring	2013-2018	2019-2024	
	5.3.1 Bird/Wildlife Aircraft Strike Hazard Prevention	2	Perform more focused avian surveys at sites deemed to be the most hazardous to aircraft operations.	Navy Mission, Sikes Act, NAWSINST 3750.2				Bird/wildlife aircraft strike hazards are reduced.
	5.5.1 Game Hunting	2	Contribute to a public website to explain public access opportunities and events in collaboration with the Cultural Resources program, MWR, and Public Relations personnel. Prepare a recreational plan with MWR for installation personnel and/or the public.	Sikes Act				DoD installations remain available to the public for hunting when not in conflict with mission or environmental goals. Compliance with chukar EA is maintained.
	5.5.2 Public Access and Outreach	2	Support public access opportunities and events, in collaboration with the Cultural Resources program, MWR, and Public Relations personnel.	Sikes Act, EO 13186, MOUs on migratory birds, Watchable Wildlife, pollinators, bat conservation, PARC, etc.				Opportunities for public access are equitably and impartially allocated, military mission impacts are avoided and safety, security and environmental issues are resolved.
	5.6 Landscaping and Grounds	2	Assist with development of an updated Landscaping Plan and Instruction consistent with applicable guidance.	EO 13123, EO 13112, Presidential Memorandum				Water resources are conserved, pesticide use reduced, and cost savings are realized by use of native and regionally adapted plants. Landscaping conforms to Base Exterior Architectural Plan, used to moderate solar heat gain, glare, dust, and wind, conserve energy, protect water quality, facilitate soil conservation, and buffer noise.
	5.7 Beneficial Partnerships and Collaborative Planning	2	Support DoD MOUs such as PARC, pollinators, migratory birds, National Biological Information Infrastructure.	Sikes Act				Partnerships and funding are improved.
	5.12.1 Cataloging and Reporting Natural Resources Information	3	Continue to digitally archive all research data and reports. Update at least every five years.	Sikes Act, OMB, DoD guidance on ecosystem approach, Navy guidance on annual INRMP program metrics.	Every 5 years			Available information is readily available to support decision-making and adaptive management. Data is collected in accordance with OMB guidelines.

EPR Number	INRMP Section	Class Level	Objective/Project or Activity	Legal Driver	Implementation Year			Measure of Success or Desired Future Condition
					Recurring	2013-2018	2019-2024	
	5.13 Training of Natural Resources Personnel	2	Ensure environmental staff receives ongoing training and professional development through attendance at workshops, classes, training, and conferences.	Sikes Act, Navy guidance on INRMP program	Annually			Necessary supplemental training to ensure the proper and efficient management of those resources is provided in a timely manner.

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Appendix B: Record of Non-Applicability

5090
PR241/004
27 Aug 13

MEMORANDUM

From: Head, Environmental Management Division (PR241)
To: File

Subj: RECORD OF NON-APPLICABILITY FOR REVISED INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN NAVAL AIR WEAPONS STATION CHINA LAKE

Ref: (a) 40 CFR 93 Subpart B "Determining Conformity of General Federal Actions to State or Federal Implementation Plans
(b) OPNAVINST 5090.1C Appendix F (General Conformity Guidance)
(c) 40 CFR §93.152 (definition of precursors of a criteria pollutant)
(d) NEPA Environmental Assessment for the Revised Integrated Natural Resource Management Plan.

1. As required by references (a) and (b), an analysis has been performed to determine the applicability of reference (a) to the following proposed project: "Revised Natural Resource Management Plan for Naval Air Weapons Station China Lake."

2. Naval Air Weapons Station China Lake is located in a combination of areas designated "attainment/maintenance", nonattainment, and attainment/unclassified for the National Ambient Air Quality Standard for Particulate Matter smaller than 10 microns (PM_{10}). It is designated "attainment/ unclassified" for all other pollutants.

3. The proposed project would update the current Integrated Resource Management Plan (INRMP) at Naval Air Weapons Station China Lake. The Revised INRMP is a long-term strategy document that would coordinate all natural resources management activities and allow for sustainable multipurpose uses of the resources. The Revised INRMP management objectives are to integrate vegetation management, wildland fire management, fish and wildlife management, land (including surface water) management, horse and burro management, and outdoor recreation as practical and consistent with the military mission, safety requirements and established land uses. The proposed project also includes the adoption of a new Wild Horse and Burro

Management Plan. The Wild Horse and Burro Management Plan provides Naval Air Weapons Station China Lake with a combination of management strategies to return the wild horse population at the Station to its appropriate management level. Management strategies include the removal of horses and burros from the Station, the use of fertility treatment to control reproductive output and the fencing of springs to prevent impacts to water, biological and cultural resources.

4. The proposed action is exempt from conformity requirements in accordance with the following paragraphs of 40 CFR 93.153(C)(2):

(ii): continued and recurring activities such as permit renewals where activities conducted will be similar in scope and operation to activities currently being conducted.

(iv): routine maintenance and repair activities, including repair and maintenance of administrative sites, roads, trails, and facilities.

(x): Action, such as the following, with respect to existing structures, properties, facilities and lands where future activities conducted will be similar in scope and operation to activities currently being conducted at the existing structures, properties, facilities, and lands…

(xiii): routine operation of facilities, mobile assets and equipment.

5. Therefore, the requirements of 40 CFR Part 93 do not apply to the proposed project.

JOHN O'GARA
Head, Environmental Management Division

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Appendix D: Natural Resources Manager Appointment Letter

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DEPARTMENT OF THE NAVY
NAVAL AIR WEAPONS STATION
1 ADMINISTRATION CIRCLE
CHINA LAKE CA 93555-6100

IN REPLY REFER TO:
5090
PR241/003
10 Jul 13

From: Commanding Officer, Naval Air Weapons Station, China Lake
To: Mr. Tom Campbell, Environmental Management Division (PR241)
Via: Commanding Officer, Naval Facilities Engineering Command Southwest (PR2)

Subj: DESIGNATION AS NATURAL RESOURCES MANAGER FOR NAVAL AIR WEAPONS STATION, CHINA LAKE

Ref: (a) OPNAVINST 5090.1C

1. Per reference (a), you are hereby designated as the Natural Resources Manager for the Naval Air Weapons Station, China Lake.

2. You are responsible for coordinating the following: management of endangered species at China Lake; implementation of the objectives of the Integrated Natural Resources Management Plan (INRMP); tracking and implementation of the requirements of Biological Opinions (BO) with the U.S. Fish and Wildlife Service (USFWS); management of the wild horse and feral burro program; compliance with natural resources rules, regulations and Navy directives; and day-to-day management of sensitive habitats and related natural resources tasks.

3. This designation remains in effect until cancelled or superseded in writing by another letter bearing the same subject.

CAPT D. A. LAZAR

Copy to:
PR2 (file)
PR241 (file, J. O'Gara)

According to NAVFAC/Navy Natural Resource Management Plan guidance a required component of the INRMP (currently being revised) is a copy of the designation letter.

Designation letters are required by:
OPNAVINST 5090.1c
Chapter 24 (Natural Resources Management)
24-13.5 COs of shore activities holding Class 1 plant accounts shall:
(e) Appoint, by letter, an installation Natural Resources Manager/Coordinator whose duties include ensuring that the CO is informed regarding: natural resources issues, conditions of natural resources, objectives of the INRMP, and potential or actual conflicts between mission requirements and natural resources mandates. Designated installation POC's are responsible for the inherently governmental decisions made on behalf of the installation and CO with regard to Sikes Act compliance.

Appendix E: Past and Current Land Use, Operations, and Activities

Table E-1. Chronological list of grazing use and related activities on Naval Air Weapons Station China Lake property.

Year	Activity
1865-1900	Livestock ranching began about this time in the vicinity of Naval Air Weapons Station China Lake (NAWS-CL). Both cattle and sheep were grazed. The Junction Ranch, owned by Domingo Etcharren and Jean Carricut, was established in the late 1800s, as was the Howard Ranch southeast of Junction Ranch (Whitley 1981). First records of horses grazing portions of the Lacey-Cactus-McCloud (LCM) Allotment are from 1885 (Bureau of Land Management [BLM] 1980).
1900-1925	In 1914, Domingo Etcharren sold the Junction Ranch to Sumner and Butler from Big Pine. They grazed cattle over much of NAWS-CL, including Mountain Springs Canyon. About 200 head of cattle are kept in Indian Wells Valley near Mountain Springs Canyon during this period. Eaton Land and Cattle Company apparently maintained a very large herd, about 5,000 head, that frequented the Argus Mountains, Mountain Springs Canyon, and Wilson Canyon on a year-around basis from roughly 1920 to 1924. Ranching from the Hidden Springs area apparently dates from the 1920s as well. Eaton Land Co. sold its holdings on NAWS-CL in 1924 to Alfred Giraud, who raised 1,000 to 2,000 sheep. George Hansen raised 600 to 700 goats in the Argus Mountains near Junction Ranch (Whitley 1981).
1930s	Burros were reported having negative impacts on springs, with accelerated erosion and environmental degradation reported (WESTEC 1979).
1934	The Taylor Grazing Act gives the U.S. Department of the Interior Grazing Service (now the BLM) authority to govern vacant lands of the U.S., provide for use and improvement of land in the public domain, and prevent overgrazing and soil deterioration. The NAWS-CL area became part of the first grazing district in California. The Grazing Service was responsible for the establishment of allotment boundaries, allocation of grazing use (number of animal unit months), and controls on season of use.
1900-1943	Horses and burros continued to be periodically gathered on NAWS-CL property for use or sale by local ranchers and mustangers. Numbers gathered were probably in the hundreds each year.
1943	NAWS-CL was established (then Naval Ordnance Test Station). In 1943, the Naval Ordnance Test Station (now NAWS-CL) was established and included parts of six active grazing allotments comprising approximately 92,300 acres of Navy lands. These included the Tunawee Common, Cactus Flat, McCloud Flat, Darwin, and Lacey allotments in the North Range, and Pilot Knob and Superior Valley allotments in the South Range. Of the original six allotments within NAWS-CL, only half were considered active within the past 25 years. These allotments had been grazed for over 100 years by cattle, and to a lesser extent by sheep. Originally the ranch headquarters (PK Ranch) and parts of the allotment were on NAWS-CL lands.
1945	Stock Operators Agreements were completed between the Navy and ten ranchers, allowing continuation of existing (Grazing Service) grazing leases on NAWS-CL lands. Ranchers were to be afforded compensation if grazing privileges were revoked.
1959	A Memorandum of Understanding was created between NAWS-CL and the BLM, whereby the BLM would be responsible for overall rangeland improvements and rehabilitation, and the administration of grazing including the monitoring of rangeland condition and the balance of appropriate livestock numbers with forage production. Preference was 585 cattle (7,020 Animal Unit Months [AUMs]).
1965-1967	The California Department of Fish and Game supervised removal of 200 burros under permit from the California Department of Food and Agriculture.
1966	Grazing adjudication was completed for establishment of carrying capacity and livestock preference of 4873 AUMs. This resulted in an established use of 600 head from November 1 to February 28, and 703 head from March 1 through May 31.
1968	The Lacey, Cactus Flat, and McCloud Flat allotments were combined into one allotment, known as the LCM Allotment, as a result of the Cabin Bar Ranch's purchase of the John Lacey rights (BLM 1984). The LCM grazing allotment encompassed the northern third of the North Range and nearby BLM-managed land to the north and west.
1969	The California Department of Fish and Game estimated 12 bighorn sheep were present in the Argus Mountains.
1971	Wild, Free-Roaming Horse and Burro Act (Public Law 92-195) passed in response to public sentiment of excessive commercial harvest of these animals. Populations began to sharply increase, first of burros, then of horses.

Year	Activity
1970s	Anecdotal information suggests that overgrazing and downward trend in rangeland condition were apparent on the North and South Ranges of NAWS-CL as early as the 1970s. For example, in 1973, a BLM rangeland specialist noted that nearly all perennial grass cover had been eliminated from the Coso Grazing Unit. Overgrazing in this unit was evident throughout usable rangeland areas. It was found to be as severe in areas used largely by feral burros as in those areas used by all three classes of grazing animals (cattle, horses, and burros). Areas near water were most heavily grazed. An estimated 500 head of cattle were run in the Coso area during this period (Ouimette 1974). In addition, rangeland condition for the Pilot Knob Allotment in the South Range was reported to be extremely variable, tending to be poor, due to drought and overgrazing by livestock and feral burros.
1980	The California Desert Conservation Area Plan (BLM 1980) rated the range in "fair" condition. Condition of areas near springs and seeps were rated as "poor." Bighorn sheep surveys revealed no sign of the animal.
1981	Burro reduction program was implemented. Livestock grazing was suspended for two years in a supplemental Memorandum of Understanding between the Navy, Cabin Bar Ranch, and the BLM. The BLM reported that nearly all perennial grasses (primary component of horse diet, 50% of burro diet) had been removed from the allotment. Allocation of forage was adjusted to 4,873 to cattle, 5,611 to range restoration, six to desert bighorn sheep, 168 to mule deer (about 200 head), 4,949 to burros, and 2,021 to wild horses. The Memorandum of Understanding also suspended cattle grazing at the Cabin Bar Ranch on NAWS-CL, during burro reduction efforts.
1982	Wild horse reduction program began. BLM's new Allotment Management Plan reduced permitted cattle numbers by 25% to 520 (3,655 AUMs) until range condition was returned to "good." An Environmental Assessment requirement was established to conduct range improvements. Subsequent to the establishment of a gunnery range in Superior Valley in the early 1980s, grazing was ultimately eliminated from the NAWS-CL portion of this allotment in 1982, reducing the total acreage of this allotment from 97,920 to 48,000 acres (39,627 to 19,425 hectares). Trespass grazing still occurred on NAWS-CL lands until a fence was constructed in 1991. Grazing on the LCM Allotment resumed again in 1982 and continued under the Allotment Management Plan until 1998.
1983	Bighorn sheep reintroduction program was implemented.
1984	North Range was rated in "fair" condition by the BLM, although the areas around water sources were rated as "poor." The latter had partial to complete removal of desirable vegetation, reduction or removal of total plant cover, compaction of soils, and overall increased rates of erosion (BLM 1984).
1985	The Grazing Management Program for NAWS-CL called for a 50% reduction in acreage grazed, from 233,535 to 116,768 acres, to "facilitate expanded mission-related activities, protect cultural and natural resources, and enhance development options for geothermal resources." The Tunawee Common Allotment included about 13,500 acres on the North Range near the Coso Known Geothermal Resource Area, on which grazing was permitted for only 1.5 months annually. It was originally a sheep allotment but was changed to cattle in 1985.
1986-1991	Permanent monitoring plots on "key areas" of the LCM Allotment, where key forage plants are present and routinely grazed, were established.
1994	The California Desert Protection Act mandated management of feral horses and burros by NAWS-CL.
1995	The BLM's Grazing Evaluation reported downward trend in range condition for the period from 1986-1995 (BLM 1995). Also, of 53 range improvements inspected in 1993 and 1994, 13 failed, one was in poor condition, ten were in fair condition, and 28 were in good condition. This evaluation, based on 20 vegetation monitoring sites, indicated a history of over-utilization by ungulates, including cattle. The over-utilization was attributed to a combination of factors, including sustained drought, improper distribution of cattle, and overuse by cattle and wild horses. Although the report does not single out any one factor over the other in causing the overall downward trend in this allotment, an examination of the monitoring data suggests that wild horses may have played a greater role in the downward trend than cattle. For example, data from the 1986-1995 studies indicate utilization by cattle near or below the livestock allocation preference of 3,136 AUMs. In the period from 1987-1995, actual use by cattle averaged 1,670 AUMs (53% of preference). In contrast, actual use by wild horses was consistently above the 2,475 AUMs allocated, averaging 5,988 AUMs or 297% above appropriate management levels (BLM 1995).
1996	A rest-rotation system was implemented by which cattle were on NAWS-CL property only in alternate years.
2000	Grazing in the LCM continued from 1998 to June 2000 under a two-year interim permit issued by the BLM. During the period of the interim permit, NAWS-CL evaluated the cattle-grazing program to determine if management adjustments were needed to ensure the program complied with applicable environmental requirements and was still compatible with NAWS-CL's mission. As a result of this evaluation, the Commanding Officer determined that cattle grazing was not compatible with the military mission and could no longer be accommodated. Formal notification of the decision was provided to the BLM Area Manager in April 2000, and cattle grazing activities were officially terminated on NAWS-CL lands in the fall of 2000.

Table E-2. Research, Development, Acquisition, Test and Evaluation and Training Operations.[1]

Air-to-Air
A typical air-to-air scenario involves the test of an air-launched, air-intercept weapon against a variety of aerial targets. Air-to-air events generally employ manned and/or unmanned aircraft, a kinetic or direct energy (DE) weapon system, a target, and countermeasure devices such, as flares or chaff. Air-to-air testing assesses and evaluates weapons and weapon systems and the integration of weapon systems with the aircraft. Activities may include inert, live motor but no warhead, or live round for firing and warhead detonation. Examples of this scenario are the launch of an AIM-9X Sidewinder missile against a full-scale aerial target or the deployment of a high-energy laser weapon from a manned platform against an unmanned aerial target. Engagement Areas: North and South Ranges and the Trona Corridor and Controlled Firing Area Associated Scattered Debris Areas: Portions of Coso North and South, Cactus Flats, Coles Flat, Darwin Wash, Junction Ranch, Coso Geothermal, Baker, Airport Lake, Charlie, SNORT, George, Mojave B North, Randsburg Wash, and Superior Valley
Surface-to-Air
Typical surface-to-air events have the same hazard patterns as air-to-air events. This scenario involves the test of a surface launched kinetic or DE weapon against a variety of aerial targets. Surface-to-air testing evaluates overall weapon system performance, warhead effectiveness, and software/hardware modifications or upgrades of ground-based weapons systems. Activities may include inert warheads or live rounds for firing and warhead detonation. Targets used in surface-to-air testing include full-scale surface launched targets, air- or surface-launched subscale targets, unmanned systems, or helicopter targets. This scenario includes the test of a ground-launch weapon from a fixed launcher. Examples of this scenario are the launch of a 2.75 HYDRA-70 rocket from a stationary launch rail, a phalanx gun systems test, or the deployment of a high-energy laser weapon against an airborne target. Engagement Areas: North and South Ranges and the Trona Corridor and Controlled Firing Area Associated Scattered Debris Areas: Portions of Coso North and South, Cactus Flats, Coles Flat, Darwin Wash, Junction Ranch, Coso Geothermal, Baker, Airport Lake, Charlie, SNORT, George, Mojave B North, Randsburg Wash, and Superior Valley
Air-to-Ground
This scenario involves the test of an air-launched, ground attack, kinetic or DE weapon against a variety of ground-based targets. Air-to-ground testing assesses and evaluates weapon systems, the integration of air-to-ground weapons or weapon systems to the aircraft, warhead effectiveness and weapon systems and/or aircraft software and hardware modifications or upgrades. Air-to-ground tests are heavily dependent on ground targets, which can include a wide variety of both vehicular and structural targets. Activities may include inert, live motor but no warhead, or live round for firing and warhead detonation. Examples of this scenario are the launch of a GBU-130 Joint Direct Attack Munition against a fixed, structural target or the deployment of a high-power microwave weapon against an electronic target. Engagement Areas: North and South Ranges and the Trona Corridor and Controlled Firing Area Target/Test Areas: Designated target and test areas throughout North and South Ranges
Surface-to-Surface
This scenario involves the test of a surface-launched, kinetic or DE weapon against a surface target. Surface-to-surface testing evaluates the overall weapon system performance, warhead effectiveness, and software/hardware modifications or upgrades of ground based weapons systems. Activities may include inert warheads or live rounds for firing and warhead detonation. Targets used in surface-to-surface testing include both fixed and mobile. This scenario includes the testing of naval guns and other types of smaller caliber guns from fixed surface sites, ground vehicles, and air platforms. Examples of this scenario are the 5/54 naval guns, ground-based DE systems, and shoulder fired weapons. Engagement Areas: Portions of Coso North and South, Coles Flat, Coso Geothermal, Airport Lake, Baker, Charlie, SNORT, George, Ordnance T&E, Main Magazines, Propulsion Laboratories, Mojave B North, Randsburg Wash, and the Trona Corridor and Controlled Firing Area Target/Test Areas: Designated target and test areas throughout North and South Ranges
Energetics/Ordnance
This scenario includes test, training, and disposal activities related to the use of energetic materials such as propellants and explosives. Much of the work conducted by the Energetics Research Division on explosives, propellants, and pyrotechnics is included in this category. In addition, the development and test of counter improvised explosive device detection and neutralization systems may be considered energetics testing. Examples include: ▪ Propulsion testing of solid fuel rocket motors ranging from small laboratory scale to large strategic systems up to 1.5 million pounds of thrust, aero-heating testing of materials and small ram jet engines, and characterization of combustion products and plume measurements of rocket motors.

[1] Descriptions are adapted from the Draft EIS/LEIS (Navy 2012a).

- Environmental and safety testing for live rounds in accordance with Military Standard-810G, Environmental Test Methods and Engineering Guidelines, or Military Standard-2105D, Department of Defense Test Method Standard: Hazard Assessment Tests for Non-Nuclear Munitions, requirements. Environmental life cycle tests include vibration, temperature, humidity, x-ray, and munitions firing. Safety tests include fast and slow cook-off, bullet and fragment impact, drop tower, and detonation. Test articles are generally live rounds undergoing either munitions testing to ensure safe deployment at sea, or qualification testing for operational deployment. All weapons systems are required to undergo this type of testing.
- Treatment of energetic hazardous waste generated from Research and Development laboratory activities, as well as munitions waste (both nonstandard items that are no longer useful to Research, Development, Acquisition, Testing and Evaluation purposes and standard items that are expired, in excess, or unsafe). Activities are performed at a permitted facility in Burro Canyon. The facility allows for the treatment of sizeable quantities of energetic wastes that cannot be safely transported off range and must be treated on-site.
- Blow in place activities to dispose of unexploded ordnance or support range activities.
- Warhead testing to measure the effectiveness of operational and development weapons, fuel-air testing, gun testing, and a large variety of specialized Research and Development activities. Test scenarios range from small explosive tests to large arena tests to characterize fragment distribution and velocity, shock and pressure waves, shaped charge performance, and overall warhead effectiveness.

Engagement Areas: Coso South, Coles Flat, Darwin Wash, Junction Ranch, Baker, Airport Lake, Charlie, SNORT, George, Armitage Field, Mainsite, Propulsion Laboratories, Main Magazines, Ordnance T&E, Mojave B North, and Ransburg Wash

Target/Test Areas: Designated target and test areas in Coso South, Coles Flat, Darwin Wash, Junction Ranch, Baker, Airport Lake, Charlie, SNORT, George, Propulsion Laboratories, Ordnance T&E, Mojave B North, and Randsburg Wash

Electromagnetics (including DE)

This scenario involves ground and flight tests that radiate radio frequency energy across much of the electromagnetic spectrum. These events may involve the release of electronic warfare (EW) defensive countermeasure devices such as chaff, flares, and decoys. Electromagnetic events include antenna pattern and radar cross-section measurements; defensive and offensive EW systems; laser systems for targeting, weapons, communication, mapping, etc.; DE weapons; experimental electromagnetics; communications; electromagnetic vulnerability of electronic systems; and other radio frequency-related testing. This category may also include the development and test of counter improvised explosive device detection and neutralization systems.

DE weapons development and test are an important component of electromagnetics.

Engagement Areas: North and South Ranges

Focused Electromagnetic Areas: Portions of Coso North and South, Cactus Flats, Coles Flat, Darwin Wash, Junction Ranch, Baker, Airport Lake, Charlie, SNORT, George, Armitage Field, Propulsion Laboratories, Ordnance T&E, Mojave B North, and Randsburg Wash

Track Test

This scenario involves the test of a kinetic or DE weapon system mounted on a sled capable of speeds ranging from subsonic to hypersonic. A test article, often a fullscale aircraft or weapon system, is propelled down the track to simulate flight conditions. Typical test track events include target penetration using live high energy warheads, live fuses, aircrew ejection systems, bombs, missiles, rockets, free flight terminal ballistics, soft recovery, EW and countermeasures, and vehicle and barrier testing. An example of this scenario is the test of a weapon system for target penetration capabilities against a fixed target, often a concrete block, mounted down-range of the muzzle section of the track. The weapon is separated from a propelled sled, which is retarded via water brake prior to the muzzle, and allowed to transit down-range to impact.

Engagement Areas: Portions of Baker, SNORT, Charlie, and Airport Lake

Target/Test Areas: Designated target and test areas in SNORT, Charlie, and Airport Lake

Table E-3. Summary of military uses by sub-range.[2]

Management Unit		Description
North Range	Airport Lake Range	Occupies approximately 57 square miles (mi^2) (148 square kilometers [km^2]) in the central portion of the North Range. It is a large playa surrounded on three sides by hills and mountains. It contains the G-4 test track, weapons target sites, unmanned systems, and ordnance impact areas.
	Armitage Airfield	Occupies approximately 13 mi^2 (34 km^2) in the southern portion of the North Range. It contains three major runways; facilities for aircraft maintenance, hangers, ordnance handling and storage; ground support equipment; and the Range Control Center.
	Baker Range	Occupies approximately 121 mi^2 (313 km^2) in the western portion of the North Range. Contains the B-4 vehicle barrier track, target sites, and ordnance impact areas.
	Cactus Flats Range	Occupies approximately 2 mi^2 (5 km^2) in the northwestern portion of the North Range. It is located at an approximate elevation of 5,100 feet and includes warhead detonation test sites.
	Charlie Range	Occupies approximately 42 mi^2 (109 km^2) in the southwestern portion of the North Range. Contains weapon target sites, ordnance impact areas, and high-speed track testing.
	Coles Flat Range	Occupies approximately 98 mi^2 (254 km^2) in the north-central portion of the North Range and includes weapons, target, and ordnance impact areas.
	Coso North Range	Occupies approximately 70 mi^2 (181 km^2) in the northwestern corner of the North Range. Represents a typical combat environment characterized by rough, mountainous terrain covered with piñon pine, juniper tree, and brush. It is located on a broad mountainous plateau and includes ordnance impact areas.
	Coso South Range	Occupies approximately 49 mi^2 (127 km^2) in the northwestern corner of the North Range and is located directly south of the Coso North Range. Represents a typical combat environment characterized by rough, mountainous terrain covered with piñon pine, juniper tree, and brush. It is located on a broad mountainous plateau and includes ordnance impact areas.
	Coso Geothermal	Occupies approximately 26 mi^2 (67 km^2) and is located southwest of the Coso South Range in the western portion of the North Range. Contains geothermal power plants, overflight for weapons training, and safety/security buffer for weapons testing.
	Darwin Wash	Occupies approximately 62 mi^2 (160 km^2) in the northeast portion of the North Range. Located at 4,500 feet, it contains a major portion of the Naval Expeditionary Combat Command Training Complex used for combat training of explosives ordnance disposal technicians and other forces, as well as Joint Counter-Improvised Explosive Device Facility.
	George Range	Occupies approximately 305 mi^2 (790 km^2) in the eastern portion of the North Range known as Indian Wells Valley. The Argus Mountains, located to the east, and the Coso Mountains, located to the north, act as natural buffers for safety and security and ideal vantage points for test instrumentation. Contains the Weapons Survivability Complex, the Burro Canyon Open Burn/Open Detonation Facility, and warhead detonation test sites and ordnance impact areas.
	Junction Ranch	Occupies approximately 65 mi^2 (168 km^2) in the northeastern part of the North Range. Test area for electromagnetic and specialized testing. Contains the Radar Cross Section Range.
	Mainsite	Occupies approximately 8 mi^2 (21 km^2) in the southern portion of the North Range. Contains NAWS-CL Headquarters, principal laboratories, housing, schools, and most administrative and support functions; is the largest developed area on-installation.
	Main Magazines	Occupies approximately 5 mi^2 (13 km^2) in the southeastern portion of the North Range. Contains ordnance storage, administrative facilities, and safety areas.
	Ordnance Test & Evaluation	Occupies approximately 90 mi^2 (233 km^2) in the southeastern corner of the North Range. Contains facilities for safety (i.e. insensitive munitions), propulsion, and warhead testing.
	Propulsion Laboratories	Occupies approximately 15 mi^2 (39 km^2) in the southeast corner of the North Range. It consists of two areas: the China Lake Propulsion Laboratory and the Salt Wells Propulsion Laboratory, each with more than 100 buildings and test facilities dedicated to propellant and explosives testing. Salt Wells is also China Lake's primary ordnance processing/manufacturing area.
	SNORT	Occupies approximately 15 mi^2 (39 km^2) in the southwest portion of the North Range. It is a heavily instrumented facility with multiple high-speed tracks and several special purpose areas with warhead testing and ordnance impact areas. The vehicle barrier track is located at SNORT.
Sout	Mojave B North Range	Occupies approximately 238 mi^2 (616 km^2) in the northern portion of the South Range. The range has two valley floors: one with a north/south orientation and the other east/west. High mountains surround each valley. Contains Wingate Airfield, weapons target sites, ordnance impact areas, aircrew training, EW test sites, and ground troop training.

[2] Descriptions are adapted from the Draft EIS/LEIS (Navy 2012a).

Management Unit		Description
	Mojave B South Range	Occupies approximately 180 mi^2 (466 km^2) in the southern portion of the South Range. Contains areas supporting aircrew training, EW test sites, and ground troop training.
	Randsburg Wash Range	Occupies approximately 282 mi^2 (730 km^2) in the central portion of the South Range. Contains Charlie Airfield and the Electronic Combat Range, unmanned systems airfield/hangar, ordnance impact areas and target sites, and numerous EW test sites. Electronic Combat Range is on the level floor of an isolated 15-mile-long valley, bordered by mountains to the north and south.
	Superior Valley	Occupies approximately 74 mi^2 (192 km^2) within Mojave B South. It is the primary location for aircrew training and tactics development, EW test sites, and ordnance impact areas.

Appendix F: Spring Specific Information

The following maps and tables provide location data for known springs on Naval Air Weapons Station China Lake (NAWS-CL) lands. Vegetation recorded at selected springs is also provided in a separate table. The information was developed based on various reports provided by NAWS-CL and in other published reports. There remain discrepancies with regards to the total number of springs and some spring names. Geographic Information System (GIS) database information was used to develop the spring location maps and provided in NAD 1983 UTM 11N. This database also contains attribute data that provides additional information on water quality, quantity, and other information. Table F-3 presents incidental observations made while performing invertebrate species work and other surveys at various springs throughout the Station. The observations are primarily based on work completed by Dr. Gordon Pratt and are included in an unpublished research report on work conducted in 1994 and 1995.

Table F-1. Global positioning system coordinates (NAD 1983 UTM 11N) for Springs within the North Range of Naval Air Weapons Station China Lake.

Spring Name	X-Coordinate	Y-Coordinate	NAWS-CL Range
Argus Spring	456112.90	3999807.50	North
Benko Spring	461796.06	3972498.75	North
Bircham Spring*	457176.59	3975935.00	North
Chappo Spring	437155.66	4004774.25	North
Cole Spring	439644.06	4000846.75	North
Coso Hot Springs	430646.66	3989232.50	North
Coso Springs	441635.41	4003754.00	North
Coso Springs	441526.31	4003706.25	North
Coso Springs	441769.91	4003776.50	North
Darwin Springs	443482.13	4003877.00	North
Darwin Springs	443515.59	4004149.50	North
Dead End Cabin Spring	437455.88	3998462.50	North
Fumaroles	430318.69	3988826.50	North
Fumaroles	430362.78	3989351.50	North
Haiwee Spring	431893.69	3997111.75	North
La Motte Spring	456688.88	3982327.50	North
Lost Cabin Spring*	437091.31	4000205.00	North
Mamm Spring	456697.75	3976208.50	North
Mammoth Mine Spring	451807.66	3978746.50	North
Margaret Ann Spring	459390.53	3979962.50	North
Mariposa Spring	439757.41	4001800.75	North
Mill Spring	437858.78	4003783.50	North
Moscow Spring	457164.50	3969440.00	North
Mountain Spring*	448915.69	3978352.75	North
New House Spring*	454420.28	3995269.25	North
Old House Spring	455530.75	3993692.00	North
Quail Spring	459470.69	3973987.25	North
Ruby Spring	461316.38	3975019.00	North
She Cat Spring	442648.97	4003224.50	North
Snooky Spring	461651.56	3979330.00	North

Spring Name	X-Coordinate	Y-Coordinate	NAWS-CL Range
Summer Spring	435969.16	3999621.50	North
Tennessee Spring*	453774.41	3995712.00	North
Upper Haiwee Spring	431581.69	3998435.00	North
Wild Horse Spring	435327.10	4000743.50	North
Wild Rose Mine Spring	452473.10	3977887.25	North
Wilson Canyon Spring	450716.09	3969984.00	North
* Indicates springs that have been fenced in the past based on EMA Inc. GIS layer attributes.			

Table F-2. Global positioning system coordinates (NAD 1983 UTM 11N) for Springs within the South Range of Naval Air Weapons Station China Lake.

Spring Name	X-Coordinate	Y-Coordinate	NAWS-CL Range
Amity Spring*	486862.41	3945859.00	South
Big Horn Spring	488422.50	3922538.50	South
Blue Chalcedony Spring	492460.72	3925371.25	South
Bottom of Layton Canyon Spring	480506.66	3948362.00	South
Cattail Spring	495663.56	3926052.25	South
Copper City Spring	482962.28	3912267.50	South
Cowboy Spring	495243.41	3914475.50	South
Crystal Springs	N/A	N/A	South
Denise Spring	N/A	N/A	South
Dust Bowl Spring*	479053.63	3954275.00	South
Early Spring	487910.34	3945411.25	South
Fresno Spring	496545.53	3919937.25	South
Granite Wells Spring*	477432.13	3916974.75	South
Hidden Spring*	505277.06	3945753.00	South
Holleys Hollow Spring	486033.00	3922994.75	South
Horn Tip Spring	486901.28	3921890.25	South
Indian Spring	495665.81	3912570.25	South
Layton Spring	483334.75	3948439.25	South
Lead Pipe Spring*	483673.91	3923455.75	South
Lone Willow Spring	487704.41	3946011.75	South
Lower Bee Hole Spring*	487311.75	3945362.50	South
Lower Tunnel Spring*	483384.94	3913308.00	South
Mesquite Spring	498350.56	3917534.00	South
Mine Shaft Spring*	487926.69	3950442.50	South
Moonshine Spring	490700.84	3924980.25	South
Myrick Spring	502760.28	3929280.25	South
New York Spring*	480918.75	3950036.25	South
Nunn Spring*	486939.88	3950670.75	South
Pink Hill Spring*	491765.50	3922381.75	South
Sandora Mine Spring	484678.84	3955219.25	South
Seep Spring	481128.38	3919022.25	South
Stone Corral Spring*	478588.50	3913955.00	South
Tank Spring	478083.75	3917258.50	South
Upper Bee Hole Spring*	486962.06	3944932.75	South
Upper Tunnel Spring*	482002.09	3914154.25	South
* Indicates springs that have been fenced in the past based on EMA Inc. GIS layer attributes.			

Plant Species Observed at Springs

Table F-3. Vegetation at Springs throughout Naval Air Weapons Station China Lake.

Spring	Species Name	Common Name
Bircham Springs		
X - 457176.59	*Artemesia tridentata*	big sagebrush
Y - 3975935.00	*Atriplex canescens*	fourwing saltbush
	Castilleja chromosa (*C. angustifolia*)	desert indian paintbrush
	Chrysothamnus nauseosus	rubber rabbitbrush
	Chrysothamnus viscidiflorus	yellow rabbitbrush
	Coleogyne ramosissima	blackbrush
	Cupressus (planted)	cypress
	Elymus sp.	wildrye
	Ephedra sp.	ephedra
	Eriogonum fasciculatum	eastern Mojave buckwheat
	Eriogonum wrightii	bastardsage
	Foresteria neomexicana (*F. pubescens* var. *pubescens*)	stretchberry
	Grayia spinosa	spiny hopsage
	Haplopappus sp.	haplopappus
	Purshia glandulosa	desert bitterbrush
	Salix lasiolepis	arroyo willow
	Sphaeralcea ambigua	desert globemallow
Coso Village		
	Artemesia tridentata	big sagebrush
	Atriplex canescens	fourwing saltbush
	Opuntia sp.	cholla cactus
	Chrysothamnus nauseosus	rubber rabbitbrush
	Cirsium sp.	plume thistle
	Coleogyne ramosissima	blackbrush
	Elymus sp. ?	wildrye
	Ephedra sp.	ephedra
	Epilobium ciliatum	fringed willowherb
	Ericameria linearifolia	narrowleaf goldenbush
	Eriogonum fasciculatum	eastern Mojave buckwheat
	Eriogonum nudum	naked buckwheat
	Eriogonum wrightii	bastardsage
	Grayia spinosa	spiny hopsage
	Guterezia sp.	snakeweed
	Juncus balticus (includes *J. mexicanus*)	Baltic rush
	Lycium sp.	boxthorn
	Opuntia sp. (long spines -flat pads)	prickly-pear
	Purshia glandulosa	desert bitterbrush
	Robinia pseudoacacia	black locust
	Rosa californica	California wildrose
	Rumex salicifolius	willow dock
	Salix exigua	narrowleaf willow
	Salix lasiolepis	arroyo willow
	Sphaeralcea ambigua	desert globemallow
	Stanleya pinnata	desert prince's plume
	Ulmus sp.	elm
	Viguiera multiflora (*Heliomeris multiflora* var. *multiflora)*	showy goldeneye
	Yucca brevifolia	Joshua tree

Spring	Species Name	Common Name
Crystal Springs		
	Artemisia dracunculus	tarragon
	Atriplex canescens	fourwing saltbush
	Castilleja chromosa (*C. angustifolia*)	desert Indian paintbrush
	Castilleja linariifolia	Wyoming Indian paintbrush
	Chrysothamnus nauseosusm	rubber rabbitbrush
	Chrysothamnus viscidiflorus	yellow rabbitbrush
	Ephedra sp.	ephedra
	Ericameria linearifolia	narrowleaf goldenbush
	Eriogonum fasciculatum	eastern Mojave buckwheat
	Eriogonum microthecum	slender buckwheat
	Eriogonum panamintense (*E. microthecum* var. *panamintense*)	Panamint buckwheat
	Eriogonum umbellatum (**nevadense*)	sulphur-flower buckwheat
	Guterezia sp.	snakeweed
	Heliotropium curassavicum	salt heliotrope
	Lycium sp.	boxthorn
	Opuntia sp.(long spines-flat pads)	prickly-pear
	Pinus monophylla	singleleaf pinyon
	Purshia glandulosa	desert bitterbrush
	Ribes velutinum	desert gooseberry
	Robinia pseudoacacia	black locust
	Rosa californica	California wildrose
	Salazaria mexicana	Mexican bladdersage
	Salix lasiolepis	arroyo willow
	Scrophularia desertorum	desert figwort
	Stanleya pinnata	desert prince's plume
	Yucca brevifolia	Joshua tree
Denise Springs		
	Ambrosia dumosa	burrobush
	Atriplex polycarpa	cattle saltbush
	Bebbia juncea	sweetbush
	Brickellia desertorum	desert brickellbush
	Larrea tridentata	creosote bush
	Echinocactus polycephalis	cottontop cactus
	Encelia virginensis	Virgin River brittlebush
	Ephedra sp.	ephedra
	Ericameria linearifolia	goldenbush
	Eriogonum fasciculatum	eastern Mojave buckwheat
	Eriogonum inflatum	desert trumpet
	Guterezia microcephala	threadleaf snakeweed
	Hymenoclea salsola	burrobrush
	Lycium sp.	boxthorn
	Opuntia basilaris	beavertail pricklypear
	Salazaria mexicana	Mexican bladdersage
	Senecio douglassii	threadleaf ragwort
	Stephanomeria sp.	wirelettuce
	Viguera reticulata	netvein goldeneye
Granite Wells		
X - 477432.125	*Arabis pulchra*	beautiful rockcress
Y - 3916974.75	*Atriplex canescens*	fourwing saltbush
	Atriplex polycarpa	cattle saltbush
	Bacharis sergiloides	desert baccharis

Spring	Species Name	Common Name
	Castilleja chromosa (*C. angustifolia*)	desert Indian paintbrush
	Opuntia sp.	cholla
	Coleogyne ramosissima	blackbrush
	Larrea tridentata	creosote bush
	Encelia actonii	Acton's brittlebush
	Ephedra sp.	ephedra
	Ericameria cuneata	cliff goldenbush
	Ericameria linearifolia	narrowleaf goldenbush
	Eriogonum fasciculatum	eastern Mojave buckwheat
	Hymenoclea salsola	burrobrush
	Lycium sp.	boxthorn
	Yucca brevifolia	Joshua tree
Spring above Granite Wells		
	Artemisia dracunculus	tarragon
	Atriplex canescens	fourwing saltbush
	Baccharis sergiloides	desert baccharis
	Baccharis sp.	baccharis
	Coleogyne ramosissima	blackbrush
	Haplopappus cuneatus (*Ericameria cuneata* var. *cuneata*)?	cliff goldenbush
	Hymenoclea salsola	burrobush, cheesebush
	Eriogonum fasciculatum	eastern Mojave buckwheat
	Larrea tridentata	creosote bush
	Prunus fasciculata	desert almond
	Salizaria sp.	bladdersage
	Stanleya pinnata	desert prince's plume
	Chrysothamnus teretifolius (*Ericameria teretifolia*)?	green rabbitbrush
	Yucca brevifolia	Joshua tree
Layton Pass Springs		
X - 483334.75	*Amsinckia tessellata*	bristly fiddleneck
Y - 3948439.25	*Astragalus laynae*	milkvetch
	Atriplex polycarpa	cattle saltbush
	Baccharis sertilloides?	
	Bacharis sergioloides	desert baccharis
	Bebbia juncea	sweetbush
	Brickellia atractyloides	spearleaf brickellbush
	Brickellia desertorum	desert brickellbush
	Bromus rubens	red brome
	Camissonia boothii	Booth's evening primrose
	Camissonia brevipes	yellow cups
	Cammisonia kernensis gilmanii	Kern County evening primrose
	Castilleja chromosa (*C. angustifolia*)	desert indian paintbrush
	Caulanthus cooperi	Cooper's wild cabbage
	Caulanthus lasiophyllus (*Guillenia lasiophylla*)	California mustard
	Chaenactus carphoclinia	pebble pincushion
	Chaenactus stevioides	Esteve's pincushion
	Chorizanthe brevicornu	brittle spineflower
	Cryptantha utahensis	scented cryptantha
	Cucurbita palmata.	coyote gourd
	Delphinium parishii	desert larkspur
	Descurainia pinnata	western tansymustard
	Distichlis spicata	saltgrass
	Echinocactus polycephalus	cottontop cactus

Spring	Species Name	Common Name
	Encelia farinosa	brittlebrush
	Encelia fremontii?	brittlebrush?
	Encelia virgininensis	Virginia River brittlebrush
	Ephedra sp.	ephedra
	Eremalche rotondifolia	desert fivespot
	Ericameria cooperi	Cooper's goldenbush
	Eriogonum deflexum	flatcrown buckwheat
	Eriogonum fasciculatum	eastern Mojave buckwheat
	Eriogonum inflatum	desert trumpet
	Eriogonum pusillum	yellowturbans
	Eriogonum reniforme	kidneyleaf buckwheat
	Eriogonum trichopes	little deserttrumpet
	Eriogonum virridescens	twotooth buckwheat
	Eriophyllum ambiguum	beautiful woolly sunflower
	Eschoscholzia minutiflora	pygmy poppy
	Euphorbia albomarginata (*Chamaesyce albomarginata*)	whitemargin sandmat
	Gilia cana?	showy gilia
	Hymenoclea salsola	burrobrush, cheesebush
	Langloisima setosissima var. *punctata*	Great Basin langloisia
	Larrea tridentata	creosote bush
	Lepidium fremontii	desert pepperweed
	Lepidium sp.	pepperweed
	Lycium andersonii	water jacket
	Malacothris glabrata	smooth desertdandelion
	Mentzelia nitens/eremophila	shining blazingstar / pinyon blazingstar
	Monoptilon bellidiforme?	daisy desertstar
	Nama demissum	purplemat
	Opuntia basilaris	beavertail pricklypear
	Oxytheca perfoliata	roundleaf oxytheca
	Perityle emoryi	Emory's rockdaisy
	Phacelia distans	distant phacelia
	Phacelia vallis-mortae	Death Valley phacelia
	Phacleia crenulata var. *ambigua*	purplestem phacelia
	Plantago ovata	desert Indianwheat
	Polypogon monspeliensis	annual rabbitsfoot grass
	Prosopis glandulosa	honey mesquite
	Psorothamnus fremontii	Fremont's dalea
	Rafinesquia neomexicna	New Mexico plumeseed
	Salazaria mexicana	Mexican bladdersage
	Salvia columbariae	chia
	Schismus barbatus	common Mediterranean grass
	Senecio douglassii (*S. flaccidus* Less. var. *flaccidus*)	threadleaf ragwort
	Sphaeralcea ambigua	desert globemallow
	Stanleya pinnata	desert prince's plume
	Stipa speciosa (*Achnatherum speciosum*)	desert needlegrass
	Thamnosma montana	turpentinebroom
	Thysanocarpus sp.	fringepod
	Trixis californica	American threefold
	Typha sp.	cattail
	Viguiera reticulata	netvein goldeneye
	Xylorhiza tortifolia	Mojave woodyaster

Spring	Species Name	Common Name
Lead Pipe Spring		
X - 483673.90625	*Ambrosia dumosa*	burrobush
Y - 3923455.75	*Atriplex polycarpa*	cattle saltbush
	Baccharis sergiloides	desert baccharis
	Castilleja angustifolia	northwestern Indian paintbrush
	Castilleja chromosa	desert indian paintbrush
	Larrea tridentata	creosote bush
	Encelia actoni	desert baccharis
	Ephedra sp.	ephedra
	Ericameria linearifolia	narrowleaf goldenbush
	Eriogonum fasciculatum	eastern Mojave buckwheat
	Eriogonum inflatum	desert trumpet
	Gutierrezia microcephala	threadleaf snakeweed
	Hymenoclea salsola	burrobrush
	Juncus sp.	rush
	Lycium sp.	boxthorn
	Prunus fasciculata	desert almond
	Salizaria mexicana	Mexican bladdersage
Lone Cabin Spring		
	Anemopsis californica	yerba mansa
	Arabis pulchra	beautiful rockcress
	Arctium lappa	greater burdock
	Argemone munita	flatbud pricklypoppy
	Artemisia dracunculus	tarragon
	Artemesia tridentata	big sagebrush
	Asclepias fascicularis	Mexican whorled milkweed
	Aster sp. *?*	
	Atriplex canescens	fourwing saltbush
	Castilleja linarifolia	Wyoming Indian paintbrush
	Chrysothamnus nauseosus	rubber rabbitbrush
	Dicentra chrysantha (*Ehrendorferia chrysantha*)	golden eardrops
	Ephedra sp.	ephedra
	Eriogonum fasciculatum	eastern Mojave buckwheat
	Eriogonum nudum	naked buckwheat
	Gutierrezia microcephala	threadleaf snakeweed
	Juncus sp.	rush
	Lupinus excubitus	grape soda lupine
	Lycium sp.	boxthorn
	Marrubium vulgare	horehound
	Pinus monophylla	singleleaf pinyon
	Purshia glandulosa	desert bitterbrush
	Rosa californica	California wildrose
	Rumex salicifolius	willow dock
	Salix lasciolepis	arroyo willow
	Sphaeralcea ambigua	desert globemallow
	Typha sp.	cattail
	Yucca brevifolia	Joshua tree
Mariposa Spring		
X - 439757.40625	*Arabis pulchrea*	beautiful rockcress
Y - 4001800.75	*Artemesia tridentate*	big sagebrush
	Asclepias fascicularis	Mexican whorled milkweed
	Atriplex canescens	fourwing saltbush

Spring	Species Name	Common Name
	Castilleja linearifolia	Wyoming Indian paintbrush
	Chrysothamnus nauseosus	rubber rabbitbrush
	Coleogyne ramosissima	blackbrush
	Elymus sp.	desert rye
	Ephedra sp.	ephedra
	Eriogonum fasciculatum	eastern Mojave buckwheat
	Eriogonum nudum	naked buckwheat
	Eriogonum umbellatum nevadense	sulphur-flower buckwheat
	Guterezia species	snakeweed
	Haplopappus sp.	haplopappus
	Juncus balticus (*mexicanus*)	Baltic rush
	Juniperus sp.	juniper
	Lycium sp.	boxthorn
	Opuntia sp. (long spines flat pads)	prickly-pear
	Pinus monophylla	singleleaf pinyon
	Purshia glandulosa	desert bitterbrush
	Salix lasiolepis	arroyo willow
	Viguiera multiflora.	showy goldeneye
	Yucca brevifolia	Joshua tree
Margaret Ann Springs		
X - 459390.53125	*Artemisia dracunculus*	tarragon
Y - 3979962.5	*Artemesia ludoviciana*	white sagebrush
	Artemesia tridentata	big sagebrush
	Atriplex canescens	fourwing saltbush
	Brickellia microphylla	littleleaf brickellbush
	Chrysothamnus nauseosus	rubber rabbitbrush
	Chrysothamnus teretifolius (*Ericameria teretifolia*)	green rabbitbrush
	Coleogyne ramosissima	blackbrush
	Ephedra sp.	ephedra
	Eriogonum fasciculatum	eastern Mojave buckwheat
	Eriogonum nudum	naked buckwheat
	Forestiera sp.	swampprivets
	Guterezia sp.	snakeweed
	Yucca brevifolia	Joshua tree
	Urtica sp.	nettle
	Purshia glandulosa	desert bitterbrush
	Rumex salicifolius	willow dock
	Salix lasiolepis	arroyo willow
Mill Spring		
X - 437858.78125	*Penstemon bridgesii*	bridge penstemon
Y - 4003783.5	*Artemesia tridentata*	big sagebrush
	Castilleja linearfolia (*Castilleja linariifolia*)	Wyoming Indian paintbrush
	Chrysothamnus nauseosus	rubber rabbitbrush
	Ephedra sp.	ephedra
	Eriogonum nudum	naked buckwheat
	Eriogonum umbellatum nevadense	sulphur-flower buckwheat
	Eriogonum umbellatum subaridum	sulphur-flower buckwheat
	Eriogonum wrightii	bastardsage
	Marrubium vulgare	horehound
	Opuntia sp. (long spines-flat pads).	prickly-pear
	Pinus monophylla	singleleaf pinyon
	Purshia glandulosa	desert bitterbrush

Spring	Species Name	Common Name
	Ribes velutinum	desert gooseberry
	Rosa californica	California wildrose
	Salix lasiolepis	arroyo willow
	Symphoricarpos sp.	snowberry
	Viola purpurea	goosefoot violet
Mountain Springs Canyon		
X - 448915.6875	*Atriplex canescens*	fourwing saltbush
Y - 3978352.75	*Atriplex polycarpa*	cattle saltbush
	Penstemon fruticosus	bush penstemon
	Chrysothamnus nauseosus	rubber rabbitbrush
	Encelia virginensis	Virgin River brittlebush
	Ericameria linearifolia	narrowleaf goldenbush
	Eriogonum fasciculatum	eastern Mojave buckwheat
	Eriogonum inflatum	desert trumpet
	Eriogonum nudum	naked buckwheat
	Guterezia sp.	snakeweed
	Yucca brevifolia	Joshua tree
	Salix lasciolepis	arroyo willow
	Larrea tridentata	creosote bush
	Lotus rigidus	shrubby deervetch
	Lupinus excubitus	grape soda lupine
	Salix laevigata	red willow
	Salizaria mexicana	Mexican bladdersage
	Sphaeralcea ambigua	desert globemallow
	Stanleya pinnatta	desert princes plume
	Stephanomeria sp.	wire lettuce
New House Spring		
X - 454420.28125	*Lupinus excubitus*	grape soda lupine
Y - 3995269.25	*Artemisia dracunculus*	tarragon
	Artemesia tridentate	big sagebrush
	Astragalus lentiginosus	freckled milkvetch
	Atriplex canescens	fourwing saltbush
	Opuntia sp.	beavertail cactus
	Penstemon fruticosus	bush penstemon
	Castilleja angustifolia	northwestern Indian paintbrush
	Castilleja chromosa	desert Indian paintbrush
	Castilleja linarifolia	Wyoming Indian paintbrush
	Opuntia sp.	cholla
	Chrysothamnus nauseosus	rubber rabbitbrush
	Coleogyne ramosissima	blackbrush
	Ephedra sp. (two sp.)	ephedra
	Eriogonum fascicualtgum	eastern Mojave buckwheat
	Eriogonum inflatum	desert trumpet
	Eriogonum nudum	naked buckwheat
	Grayia spinosa	spiny hopsage
	Guterezia sp.	snakeweed
	Haplopappus sp.	haplopappus
	Mimulus cardinalis	scarlet monkeyflower
	Phragmites sp.	common reed
	Pinus monophylla	singleleaf pinyon
	Salix lasiolepis	arroyo willow
	Salazaria mexicana	Mexican bladdersage

Spring	Species Name	Common Name
	?	tall gray composite
	Yucca brevifolia	Joshua tree
Pink Hill Spring		
X - 491765.5	*Ambrosia dumosa*	burrobush
Y - 3922381.75	*Atriplex canescens*	fourwing saltbush
	Atriplex polycarpa	cattle saltbush
	Baccharis sergiloides	desert baccharis
	Typha sp.	cattail
	Opuntia sp.	cholla
	Larrea tridentata	creosote bush
	Ephedra sp.	ephedra
	Eriogonum inflatum	desert trumpet
	Grayia sp.	hopsage
	Guterezia microcephala	threadleaf snakeweed
	Lycium sp.	boxthorn
	Senecio douglassii	threadleaf ragwort
Seep Spring		
X - 481128.375	*Atriplex cannescens*	fourwing saltbush
Y - 3919022.25	*Allium fimbriatum?*	fringed onion
	Allium sp. (need bulbs)	onion
	Ambrosia dumosa	burrobush
	Amsinkia intermedia (*A. menziesii* var. *intermedia*)	common fiddleneck
	Amsinkia tessellata	bristly fiddleneck
	Arabis sp.	rockcress
	Asclepias erosa	desert milkweed
	Atriplex polycarpa	cattle saltbush
	Baccharis sergiloides	desert baccharis
	Opuntia sp.	beavertail cactus
	Bromus rubens	red brome
	Castilleja chromosa (*C. angustifolia*)	desert indian paintbrush
	Caulanthus lasiophyllus (*Guillenia lasiophylla*)	California mustard
	Chenopodium californicum	California goosefoot
	Opuntia *sp.*	cholla
	Chorizanthe watsonii	fivetooth spineflower
	Cirsium mohavense	Mojave thistle
	Claytonia parviflora	streambank springbeauty
	Coleogyne ramosissima	blackbrush
	Delphinium parishii	desert larkspur
	Dicholostemma capitata	bluedicks
	Echinocereus engelmanni	Engelmann's hedgehog cactus
	Encelia actoni Hymenoclea salsola and *Eriastrum difusum?*	burrobrush
	Encelia virginensis	Virgin River brittlebrush
	Ephedra sp.	ephedra
	Eriastrum eremicum	desert woollystar
	Ericameria cuneata	cliff goldenbush
	Ericameria linearifolia	narrowleaf goldenbush
	Eriogonum fasciculatum	eastern Mojave buckwheat
	Eriogonum heermanii	Heermann's buckwheat
	Eriogunum inflatum	desert trumpet
	Escholtzia minutiflora	pygmy popppy
	Forresteria neomexicana (*F. pubescens* var. *pubescens*)	stretchberry
	Grayia spinosa	spiny hopsage

Spring	Species Name	Common Name
	Gutierrezia microcephala	threadleaf snakeweed
	Hymenoclea salsola	burrobrush
	Larrea tridentata	creosote bush
	Lasthenia gracilis (*californica*)	needle goldfields
	Lasthenia sp.	goldfields
	Lycium cooperi	peach thorn
	Mimmulus guttatus	seep monkeyflower
	Nacotiana obtusifolia	desert tobacco
	Phacelia distans	distant phacelia
	Poa secunda	sandberg bluegrass
	Prunus fasciculata	desert almond
	Rumex crispus	curly dock
	Salazaria mexicana	Mexican bladdersage
	Sphaeralcea ambigua	desert globemallow
	Trifolium gracilentum	pinpoint clover
	Xylorhyza tortifolia	Mojave woodyaster
Stone Corral		
	Stanleya pinnata.	desert prince's plume
	Atriplex canescens	fourwing saltbush
	Bacharis sergioloides	desert baccharis
	Hymenoclea salsola	burrobush, cheesebush
	Encelia virginiensis	Virginia River brittlebrush
	Ephedra sp.	ephedra
	Eriogonum fasciculatum	eastern Mojave buckwheat
	Guterezia sp.	snakeweed
	Haploppapus linearifolius	narrowleaf goldenbush
	Krameria sp.	ratany
	Larrea tridentate	creosote bush
	Lepidospartum	broomsage
	Lycium sp.	boxthorn
	Prunus fasciculata	desert almond
	Salazaria sp.	bladder sage
Tennessee Spring		
X - 453774.40625	*Atriplex canescens*	fourwing saltbush
Y - 3995712	*Penstemon fruticosus*	bush penstemon
	Opuntia sp.	cholla
	Chrysothamnus nauseosus	rubber rabbitbrush
	Coleogyne ramosissima	blackbrush
	Aquilegia sp. ?	Columbine
	Ephedra sp.	ephedra
	Eriogonum fasciculatum	eastern Mojave buckwheat
	Eriogonum heermanii	Apache buckwheat
	Eriogonum inflatum.	desert trumpet
	Eriogonum nudum	naked buckwheat
	Grayia spinosa	spiny hopsage
	Guterezia sp.	snakeweed
	Haploppapus sp.	goldenbush
	Yucca brevifolia	Joshua tree
	Lupinus excubitus	grape soda lupine
	Lycium sp.	boxthorn
	Mimmulus cardinalis	scarlet monkeyflower
	Pinus monophylla	singleleaf pinyon

Spring	Species Name	Common Name
	Salizaria mexicana	Mexican bladdersage
	Stanleya pinnatta	desert prince's plume
Upper Tunnel Spring		
X - 482002.09375	*Atriplex canescens*	fourwing saltbush
Y - 3914154.25	*Coleogyne ramosissima*	blackbrush
	Hymenoclea salsola	burrobush, cheesebush
	Larrea tridentata	creosote bush
	Yucca brevifolia	Joshua tree
	Lycium sp.	boxthorn
Wildhorse Spring		
X - 435327.0625	*Penstemon bridgesii*	bridge penstemon
Y - 4000743.5	*Artemisia dracunculus*	tarragon
	Artemesia tridentata	big sagebrush
	Atriplex canescens	fourwing saltbush
	Ceanothus greggii	desert ceanothus
	Chrysothamnus nauseosus	rubber rabbitbrush
	Chrysothamnus viscidiflorus	yellow rabbitbrush
	Dicentra chrysantha (Ehrendorferia chrysantha)	golden eardrops
	Elymus sp.	desert rye
	Ephedra sp.	ephedra
	Eriogonum fasciculatum	eastern Mojave buckwheat
	Eriogonum microthecum	slender buckwheat
	Eriogonum nudum	naked buckwheat
	Eriogonum umbellatum nevadense.	sulphur-flower buckwheat
	Eriogonum umbellatum subaridum	sulphur-flower buckwheat
	Eriogonum wrightii	bastardsage
	Forestiera neomexicana (*F. pubescens* var. *pubescens*)	stretchberry
	Lycium sp.	boxthorn
	Pinus monophylla	singleleaf pinyon
	Prunus andersoni	desert almond
	Purshia glandulosa	desert bitterbrush
	Ribes velutinum	desert gooseberry
	Rosa californica	California wildrose
	Salix lasciolepis	arroyo willow
	Urtica holosericea (*Urtica dioica* subsp. *holosericea*)	stinging nettle

This table of plant species occurring at different springs throughout NAWS-CL is based on incidental observations that were made while performing focused invertebrate species (Pratt, Unpublished).
In some cases the spelling of the species recorded originally were incorrect and they were corrected during the development of this table. Furthermore, new species names have been given to some of the species observed since the survey effort, and the current naming classification was applied when such cases occurred.

Appendix G: Landscaping Plant List

Table G-1. Native plants for landscaping and propagation in Eastern Sierra Nevada regions (provided by Bristlcone Chapter of California Native Plant Society 2010).

Scientific Name	Common Name	Family	Lifespan	Form	Flower
Achillea millefolium	yarrow	Asteraceae	perennial	herb	white
Achnatherum nevadensis	Nevada needlegrass	Poaceae	perennial	grass	n/a
Achnatherum speciosum	desert needlegrass	Poaceae	perennial	grass	n/a
Angelica lineariloba	Sierra Angelica	Apiaceae	perennial	herb	white
Apocynum cannabinum	Indian hemp, dogbane	Apocynaceae	perennial	herb	white
Aquilegia formosa	red columbine	Ranunculaceae	perennial	herb	red
Arnica mollis	cordilleran arnica	Asteraceae	perennial	herb	yellow
Artemisia arbuscula	low sagebrush	Asteraceae	perennial	shrub	greenish white
Asclepias fascicularis	narrow-leaf milkweed	Asclepiadaceae	perennial	herb	white
Asclepias speciosa	showy milkweed	Asclepiadaceae	perennial	herb	pink
Astragalus coccineus	scarlet milk vetch	Fabaceae	perennial	herb	red
Atriplex canescens	fourwing saltbush	Chenopodiaceae	perennial	shrub	green
Calystegia longipes	bush morning glory	Convolvulaceae	perennial	herb	white
Ceanothus greggii var. *vestitus*	desert ceanothus	Rhamnaceae	perennial	shrub	white
Ceanothus leucodermis	chaparral whitethorn	Rhamnaceae	perennial	shrub	white
Celtis laevigata var. *reticulata*	western hackberry	Ulmaceae	perennial	tree	n/a
Cercocarpus ledifolius	mountain mahogany	Rosaceae	perennial	shrub	white or blue
Chamaebatiaria millefolium	fern bush	Rosaceae	perennial	shrub	white
Chilopsis linearis	desert willow	Bignoniaceae	perennial	tree	pink
Chrysothamnus viscidiflorus	curly-leaf rabbitbrush	Asteraceae	perennial	shrub	yellow
Clematis ligusticifolia	virgin's bower	Ranunculaceae	perennial	vine	white
Coleogyne ramosissima	blackbrush	Rosaceae	perennial	shrub	yellow
Cryptantha confertiflora	golden forget-me-not	Boraginaceae	perennial	herb	yellow
Datura wrightii	jimson weed	Solanaceae	perennial	herb	white
Elymus elymoides	squirreltail	Poaceae	perennial	grass	n/a
Encelia actoni	bush sunflower	Asteraceae	perennial	shrub	yellow
Ephedra nevadensis	desert ephedra	Ephedraceae	perennial	shrub	yellow
Ephedra viridis	green ephedra	Ephedraceae	perennial	shrub	yellow
Epilobium angustifolium	fireweed	Onagraceae	perennial	herb	purple or pink
Eremogone kingii var. *glabrescens*	king's sandwort	Caryophyllaceae	perennial	herb	white
Eriastrum densifolium	heavenly blue	Polemoniaceae	perennial	herb	blue
Erigeron compactus	fernleaf fleabane	Asteraceae	perennial	herb	white and purple
Eriogonum fasciculatum var. *polifolium*	California buckwheat	Polygonaceae	perennial	shrub	white and pink
Eriogonum nudum var. *westonii*	nude buckwheat, Weston's buckwheat	Polygonaceae	perennial	shrub	yellow
Eriogonum umbellatum var. *nevadense*	sulphur buckwheat	Polygonaceae	perennial	herb	yellow
Eriogonum elatum	tall buckwheat	Polygonaceae	perennial	herb	white and pink

Scientific Name	Common Name	Family	Lifespan	Form	Flower
Eriophyllum confertiflorum	golden yarrow, wooly sunflower	Asteraceae	perennial	shrub	yellow
Erysimum capitatum	western wallflower	Brassicaceae	perennial	herb	orange
Forestiera pubescens	desert olive	Oleaceae	perennial	shrub	yellow
Frangula californica	coffeeberry	Rhamnaceae	perennial	shrub	whitish (creamy yellowish)
Frangula californica subsp. *tomentella*	hoary coffeeberry or California Buckthorn	Rhamnaceae	perennial	shrub	white
Heliomeris multiflora var. *nevadensis*	Nevada goldeneye	Asteraceae	perennial	herb	yellow
Hesperostipa comata	needle and thread grass*	Poaceae	perennial	grass	n/a
Heuchera rubescens	coral bells or pink alumroot	Saxifragaceae	perennial	herb	pink
Hymenoclea salsola	burro bush, desert pearl	Asteraceae	perennial	shrub	white (sometimes yellow or pink)
Koeleria macrantha	junegrass	Poaceae	perennial	grass	n/a
Lepidium fremontii	desert allysum	Brassicaceae	perennial	herb	white
Leymus cinereus	Great Basin wild rye	Poaceae	perennial	grass	n/a
Leymus triticoides	creeping wild rye	Poaceae	perennial	grass	n/a
Lupinus argenteus var. *heteranthus*	shrubby lupine	Fabaceae	perennial	herb	blue or purple
Lupinus argenteus	Sierra bush lupine	Fabaceae	perennial	herb	blue or purple
Lupinus excubitus	Inyo bush lupine	Fabaceae	perennial	shrub	blue or purple
Lupinus polyphyllus	creek lupine	Fabaceae	perennial	herb	blue or purple
Mimulus guttatus	yellow monkeyflower	Phrymaceae			
(formerly Scrophulariaceae)	annual or perennial	herb	yellow		
Mimulus cardinalis	scarlet monkey-flower	Phrymaceae			
(formerly Scrophulariaceae)	perennial	herb	red		
Mimulus lewisii	Lewis monkeyflower	Phrymaceae			
(formerly Scrophulariaceae)	perennial	herb	pink		
Mirabilis alipes	rose four-o'clock	Nyctaginaceae	perennial	herb	pink
Monardella odoratissima	mountain pennyroyal, desert mint	Lamiaceae	perennial	herb	blue or purple
Muhlenbergia asperifolia	scratch grass	Poaceae	perennial	grass	n/a
Oenothera caespitosa subsp. *marginata*	large white evening primrose	Onagraceae	perennial	herb	white
Oenothera elata	Hooker's evening primrose	Onagraceae	perennial	herb	yellow
Oenothera xylocarpa	wood fruit evening primrose	Onagraceae	perennial	herb	yellow
Packera multilobata	lobeleaf groundsel	Asteraceae	perennial	herb	yellow
Penstemon floridus var. *floridus*	rose penstemon*	Scrophulariaceae	perennial	herb	pink
Penstemon fruticiformis	desert mountain penstemon	Scrophulariaceae	perennial	herb	blue or purple (pale)
Penstemon eatonii	firecracker penstemon	Scrophulariaceae	perennial	herb	red
Penstemon floridus var. *austinii*	Austin's penstemon	Scrophulariaceae	perennial	herb	pink
Penstemon incertus	Mojave beardtongue	Scrophulariaceae	perennial	shrub	blue or purple
Penstemon monoensis	Mono penstemon	Scrophulariaceae	perennial	herb	purple or pink
Penstemon patens	Owens valley penstemon	Scrophulariaceae	perennial	herb	purple
Penstemon rostriflorus	scarlet penstemon	Scrophulariaceae	perennial	herb	red
Pericome caudata	mountain tail leaf	Asteraceae	perennial	herb	orange
Phoenicaulis cheiranthoides	daggerpod	Brassicaceae	perennial	herb	purple or pink
Pinus jeffreyi	Jeffrey pine	Pinaceae	perennial	tree	n/a

Scientific Name	Common Name	Family	Lifespan	Form	Flower
Prosopis pubescens	screw-bean mesquite	Fabaceae	perennial	tree or shrub	yellow
Prunus andersonii	desert peach	Rosaceae	perennial	shrub	pink
Psorothamnus arborescens	indigo bush	Fabaceae	perennial	shrub	purple
Purshia tridentata	bitterbrush	Rosaceae	perennial	shrub	yellow (creamy white with yellow center)
Ribes cereum	wax currant	Grossulariaceae	perennial	shrub	pink or white
Salazaria mexicana	bladder sage	Lamiaceae	perennial	shrub	purple and white
Salix gooddingii	black willow	Salicaceae	perennial	tree	n/a
Salvia dorrii	purple sage*	Lamiaceae	perennial	shrub	purple
Sambucus nigra subsp. *cerulea*	blue elderberry	Caprifoliaceae	perennial	tree (or large shrub)	white or creamy yellow
Senecio flaccidus	Mono ragwort	Asteraceae	perennial	shrub	yellow
Solidago californica	California goldenrod	Asteraceae	perennial	herb	yellow
Solidago spectabilis	basin goldenrod	Asteraceae	perennial	herb	yellow
Sphaeralcea ambigua	apricot globe mallow*	Malvaceae	perennial	herb	orange
Sphenosciadium capitellatum	Ranger's buttons	Apiaceae	perennial	herb	white
Sporobolus airoides	alkali sacaton	Poaceae	perennial	grass	n/a
Stanleya elata	Panamint prince's plume	Brassicaceae	perennial	herb	yellow
Stanleya pinnata	desert prince's plume*	Brassicaceae	perennial	herb	yellow
Townsendia scapigera	Easter daisy	Asteraceae	perennial	herb	white
Xylorhiza tortifolia	Mojave aster	Asteraceae	perennial	herb	purple

Table G-2. Approved plant list for Naval Air Weapons Station China Lake.

Naval Air Weapons Station China Lake				
Approved Plant List (Naval Facilities Engineering Command Southwest 2008)				
Conditions of Use				
1. For each project, California native species from the approved plant list shall constitute a minimum of 60% of the number of plants within each stratum (herb, shrub, and tree). Other drought tolerant species from this list shall constitute the remainder of the plant material (a maximum of 40% in each stratum) for each project. A higher proportion of natives may be required for projects within or adjacent to natural areas. The determination of whether cultivars are considered native or exotic will be made on a project-by-project basis by the Navy points of contact listed above.				
2. It is vital that coordination with the Navy points of contact listed above occur early in the planning process to determine site-specific needs and constraints. Please note that not all species on this list are appropriate for all settings. For example, in some areas trees may not be approved due to Bird/Animal Aircraft Strike Hazard risks and/or the presence of federally listed species.				
3. Additional native and non-native drought-tolerant species may be included in the landscape design (and potentially added to the approved plant list) contingent upon the approval of the Navy points of contact listed above. Additional species must be identified early in the planning stages of the project design.				
4. All plants shall be verified for availability in size and quantities needed for each project prior to specifying on plans or scopes of work.				
5. This list is updated periodically. Prior to initiating a project, please obtain the most recent list from either of the Navy points of contact listed above.				
Common Name (Botanical Name)	**Native Status**	**Height**	**Spread**	**Irrigation Needs**
Annuals/Bulbs/Perennials/Succulents				
yarrow (*Achillea millefolium* var. *rosea*)	CA	3'	3'	L
lily of the Nile (*Agapanthus* spp.)	E	3'	2'	L
century plant (*Agave deserti*)	N	15'	2'	L
century plant (*Agave utahensis*)	CA	15'	2'	L
beautiful rockcress (*Arabis pulchra gracilis*)	N	3'	1'	L
desert marigold (*Baileya multiradiata*)	CA	3'	3'	L
Mariposa lily (*Calochortus* spp.)	CA or N	3'	1'	L
antelope and rabbitbrush (*Chrysothamnus nauseosus* var. *hololeucus*)	N	3'	3'	L

Owens rabbitbrush (*Chrysothamnus nauseosus* var. *viscosus*)	N	3'	6'	L
desert spoon (*Dasylirion* spp.)	E	6'	6'	L
sky blue larkspur (*Delphinium parishii*)	N	3'	2'	L
desert encelia (*Encelia actoni*)	N	3'	2'	L
California fucshia (*Epilobium canum*)	N	1'	3'	L
winterfat (*Eurotia lanata*)	N	3'	3'	L
Compass barrel cactus (*Ferocactus cylindraceus*)	N	6'	1'	L
barrel cactus (*Ferocactus* spp.)	N, CA, E	Varies	Varies	L
giant gum plant (*Grindelia camporum*)	N	3'	3'	L
narrow-leaf golden bush (*Haplopappus linearifolius*)	N	3'	3'	L
red yucca (*Hesperaloe parviflora*)	E	4' (5')	4' (5')	L
goldfields (*Lasthenia glabrata*)	N	6"	6"	L
grape soda lupine (*Lupinus excubitus*)	N	4'	3'	L
Mojave aster (*Machaeranthera tortifolia*)	N	2'	2'	L
common monolopia (*Monolopia lanceolata*)	N	3'	3'	L
beargrass (*Nolina bigelovii*)	CA	6'	4'	L
evening primrose (*Oenothera caespitosa* var.*marginata*)	N	1'	2'	L-M
firecracker penstemon (*Penstemon eatonii*)	N	3'	2'	L
pink showy penstemon (*Penstemon pseudospectabilis*)	CA	5'	3'	L
showy penstemon (*Penstemon spectabilis*)	N	5'	3'	L
desert surprise (*Penstemon thurberi*)	N	4'	3'	L
Utah penstemon (*Penstemon utahensis*)	N	2'	1'	L
New Zealand flax (*Phormium tenas*)	E	4'	4'	M
desert mallow (*Sphaeralcea ambigua*)	N	2'	1'	L
prince's plume (*Stanleya pinnata*)	CA	4'	3'	L
desert sunflower (*Viguiera deltoidea parishii*)	N	3'	2'	L
Mojave yucca (*Yucca schidigera*)	N	8'	3'	L
Grasses/Rushes				
clustered field sedge (*Carex praegracilis*)	N	2'	3'	L-M
saltgrass (*Distichlis spicata* var. *spicata*)	N	6"	15'	L-M
blue fescue (*Festuca ovina*)	E	1'	1'	L-M
spiny rush (*Juncus acutus* subsp. *leopoldii*)	CA	5'	6'	L-M
California melic (*Melica imperfecta*)	N	2'	2'	L-M
deer grass (*Muhlenbergia rigens*)	N	4' (5')	4' (5')	L-M
Indian rice grass (*Oryzopsis hymenoides*)	N	2'	1'	L-M
pine bluegrass (*Poa scabrella*)	N	3'	2'	L
alkali sacaton (*Sporobolus airoides*)	N	3'	3'	L
desert bunch grass (*Stipa speciosa*)	N	3'	1'	L
Ground Covers				
desert sand verbena (*Abronia pogonantha*)	N	1'	1'	L
sand verbena (*Abronia villosa*)	N	1'	6'	L
coyotebrush (*Baccharis pilularis* varieties)	CA or E	2'	6'	M
desert marigold (*Baileya multiradiata*)	CA	1'	1'	L
dainty yellow composite (*Thymophylla pentachaeta* var. *belenidium*)	CA	1'	1'	L
lavender cotton (*Santolina* spp.)	E	2'	2'	L-M
Shrubs				
cat claw (*Acacia greggii*)	CA	15'	12'	L
big sagebrush (*Artemisia tridentata*)	N	12'	8'	L
emory baccharis (*Baccharis emoryi*)	CA	9'	6'	L-M
sticky baccharis (*Baccharis glutinosa*)	CA	6'	6'	M

chaparral broom (*Baccharis pilularis consanguinea*)	CA	13'	10'	L-M
broom baccharis (*Baccharis sarothroides*)	CA	9'	9'	L-M
squaw waterweed (*Baccharis sergiloides*)	CA	6' (9')	3'	M
mulefat (*Baccharis viminea*)	CA	13'	10'	L-M
wintergreen boxwood (*Buxus microphylla*)	E	6'	6'	L
bird of paradise (*Caesalpinia gilliesii*)	E	10'	6'	M
flowering quince (*Chaenomeles* spp.)	E	2-9'	2-6'	L-M
fairy duster (*Calliandra eriophylla*)	CA	4' (1')	4' (1')	L
incienso (*Encelia farinosa*)	N	4' (5')	4' (5')	L
desert olive (*Forestiera neomexicana*)	N	9'	12'	L-M
ocotillo (*Fouquieria splendens*)	CA	20'	8'	L
hopsage (*Grayia spinosa*)	N	4'	4'	L
toyon (*Heteromeles arbutifolia*)	N	8'	15'	L-M
bladderpod (*Isomeris arborea*)	N	5'	5'	L
juniper (*Juniperis* spp.)	E	Varies (10')	Varies (6')	L-M
chuparosa (*Justica californica*)	CA	3'	5' (3')	L
yellow bush snapdragon (*Keckiella antirrhinoides*)	N	6'	8' (4')	L
creosote bush (*Larrea tridentata*)	N	9' (15')	9'	L
Texas ranger (*Leucophyllum frutescens*)	E	6'-8' (12')	6'-8' (12')	L
Texas ranger (*Leucophyllum frutescens cultivars*)	E	3'-5'	3'-5'	L
waterjacket (*Lycium andersonii*)	N	9'	6'	L
beavertail cactus (*Opuntia basilaris*)	N	2'	2'	L
Photinia x *fraseri*	E	10'	10'	M
Photinia x *fraseri* (cultivars)	E	5'	5'	M
arrow weed (*Pluchea sericea*)	N	6'	4'	L
desert almond (*Prunus fasciculata*)	N	3' (7')	7'	L
desert apricot (*Prunus fremontii*)	N	9'	9'	L-M
pomegranate (*Punica granatum* (*cultivars*))	E	Varies	Varies	L-M
firethorn (*Pyracantha* spp.)	E	Varies (15')	Varies (10')	L-M
coffeeberry (*Rhamnus californica cuspidata*)	N	9'	9'	L-M
coffeeberry (*Rhamnus californica* (*cultivars*))	CA or E	Varies	Varies	L-M
Indian hawthorne (*Rhaphiolepis indica*)	E	12'	10'	M
Indian hawthorne (*Rhaphiolepis indica* (*cultivars*))	E	Varies	Varies	M
Woods' rose (*Rosa woodsii glabrata*)	N	3'	4'	M
rosemary (*Rosmarinus officinalis*)	E	Varies	Varies	L-M
bladder-sage (*Salazaria mexicana*)	N	5'	3'	L
jojoba (*Simmondsia chinensis*)	CA	5'	5'	L
Trees				
white alder (*Alnus rhombifolia*)	CA	75'	40'	M
river birch (*Betula nigra*)	E	30'	30'	M
hackberry (*Celtis reticulata* (*pallida*))	N	30'	30'	L-M
Palo Verde (*Cercidium* (*Parkinsonia*) *floridum*)	CA	30'	25'	L-M
little-leaf Palo Verde (*Cercidium microphyllum*)	N	30'	25'	L
western redbud (*Cercis occidentalis*)	N	20'	20'	M
Mediterranean fan palm (*Chamaerops humilis*)	E	20'	8'	L-M
desert willow (*Chilopsis linearis*)	CA	35'	30'	L-M
chitalpa (*Chitalpa tashkentensis*)	CA	30'	20'	L-M
smoke tree (*Dalea spinosa*)	CA	25'	20'	L
Arizona ash (*Fraxinus velutina*)	CA	30'	25'	L
raywood ash (*Fraxinus oxycarpus*)	CA	35'	25'	M
crape myrtle (*Lagerstroemia indica*)	E	20'	20'	M
mondell pine (*Pinus brutia*)	E	50'	25'	L-M
mondell pine (*Pinus eldarica*)	E	50'	25'	L-M
aleppo pine (*Pinus halepensis*)	E	50'	35'	L-M

California sycamore (*Platanus racemosa*)	N	50'	80'	M
honey mesquite (*Prosopis glandulosa* var. *torreyana*)	N	20'	25'	L
screwbean mesquite (*Prosopis pubescens*)	N	20'	15'	L
flowering plum (*Prunus* spp.)	E	20'-40'	10'-30'	L-M
pomegranate (*Punica granatum*)	E	20'	20'	L-M
evergreen pear (*Pyrus kawakamii*)	E	20'	20'	L-M
San Joaquin willow (*Salix gooddingii*)	N	30'	30'	M
chaste tree (*Vitex* spp.)	E	20'	20' (10')	L-M
California fan palm (*Washingtonia filifera*)	CA	45'	10'	M
Vines				
trumpet vine (*Campsis radicans*)	E	30'	30'	L-M
cat claw trumpet vine (*Macfadyena ungis-cacti*)	E	30'	30'	L
snapdragon vine (*Maurandya antirrhiniflora*)	CA	10'	4'	L
lady bank's rose (*Rosa banksiae*)	E	25'	25'	M
star jasmine (*Trachelospermum jasminoides*)	E	20'	20'	M
southern California grape (*Vitis girdiana*)	CA	30'	30'	M
N= Native to Kern County, CA= Other California Native, E= Exotic, L= Low Water, M= Moderate Water, L-M= Low to Moderate Water				

Table G-3. Do Not Plant List. Plants unacceptable for landscaping under any circumstances (supplied by Naval Facilities Engineering Command Southwest).

Scientific name	**Common Name**
Albizia julibrissin	mimosa tree
Aptenia spp.	red apple ice plant
Asphodelus fistulosus	onion weed
Carpobrotus spp.	hottentot fig ice plant
Cephallophyllum spp.	red spike ice plant
Chrysanthemum spp.	chrysanthemum
Cortaderia spp.	pampas grass
Delosperma spp.	Disneyland ice plant
Dorotheanthus spp.	Livingstone daisy ice plant
Gazania spp.	gazania, treasure flower
Hypericum canariense	St. John's wort
Lampranthus (*Oscularia*) spp.	ice plant
Malephora spp.	ice plant
Mesembryanthemum spp.	ice plant
Myoporum laetum	ngaio tree
Oleander spp.	oleander
Pennisetum spp.	fountain grass
Platanus acerifolia	London plane tree - hybridizes with native
Rhus lancea	African sumac
Schinus terebinthifolius	Brazilian pepper-tree
Tamarix spp.	tamarisk, salt-cedar
Tragopogon spp.	goat's beard
All plants on the California Invasive Plant Council Invasive Plant Inventory (see http://www.cal-ipc.org) and all non-native grasses (except those used for turf/lawns or those included in the approved list) are unacceptable.	

Appendix H: Installation Restoration Sites and Approved Pesticide List

H.1 Installation Restoration Sites

Table H-1. Summary of Naval Air Weapons Station China Lake Installation Restoration Program Sites (Navy 2004b).

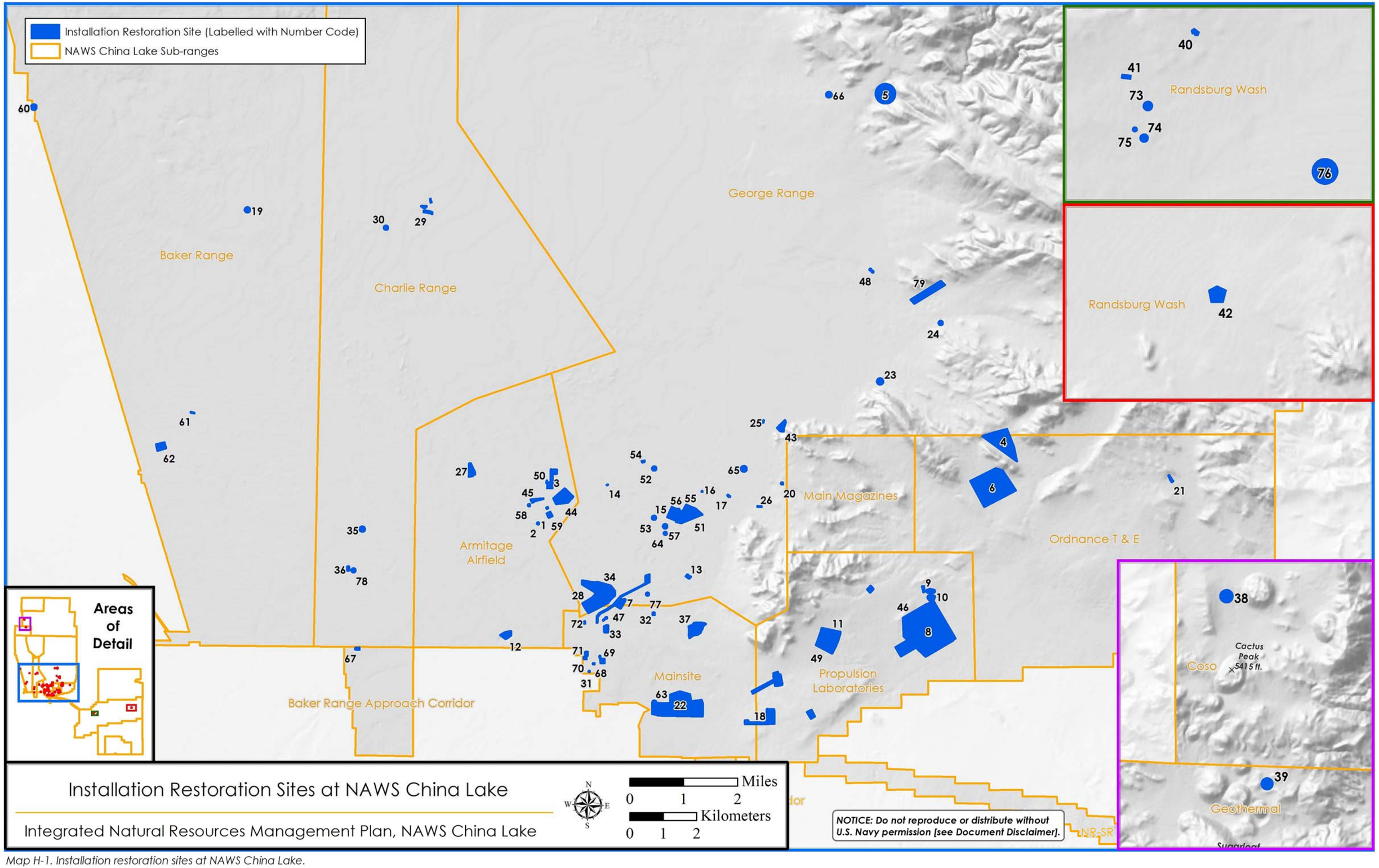
Site	Site Name	Cause of Contamination	Medium	Status*
1	Armitage Airfield Dry Wells (Building 20023)	Substandard jet fuel was disposed of into dry wells	Soil, possible groundwater	Removal & RI/FS
2	Aircraft Washdown Drainage Ditches - Armitage Airfield	Used engine fluids and solvents from maintenance activities were discharged into an unlined ditch	Soil, groundwater	RI/FS
3	Armitage Airfield Leach Pond	Sanitary and industrial waste from airfield operations were discharged into an evaporation/ leach pond	Groundwater, soil	RI/FS
4	Beryllium-Contaminated Equipment Disposal Area	Beryllium-contaminated equipment and structures were burned and buried	Soil	NFA
5	Burro Canyon Open Burning/Open Detonation (Building 32529)	Propellant, Explosive and Pyrotechnic (PEP) and some non-PEP materials	Air, soil	NFA
6	T-Range Disposal Area	Disposal of PEP materials and contaminated trash by open burning; residual wastes were buried in unlined trenches	Air, soil	Removal
7	Michelson Laboratory Drainage Ditches (Building 00005)	Acid and chemical wastes were discharged into unlined ditches	Soil, groundwater	RI/FS
8	Salt Wells Drainage Channels	Chemical waste waters were discharged into natural drainage channels	Soil, possibly groundwater	RI/FS
9	Salt Wells Asbestos Trenches	Asbestos from various Station activities was disposed of in three slit trenches	Soil	NFA
10	Salt Wells Disposal Trenches	Solid and liquid wastes from Salt Wells labs were disposed of in ten slit trenches	Soil	NFA
11	China Lake Propulsion Labs Evaporation Ponds (Buildings 10570 and 10580)	Wastewater from PEP machining operations was discharged into unlined ponds	Groundwater, soil	NFA
12	SNORT Road Landfill	Old gravel quarry was filled with hazardous and nonhazardous wastes from various activities	Soil, groundwater	RI/FS
13	Oily Waste Disposal Area (Water Road)	Waste oils from maintenance activities and grease traps were disposed of in two slit trenches	Soil, groundwater	RI/FS & removal
14	ER Range Septic System (Buildings 31434, 31440, 31433, and 31439)	Lab and sanitary waste from five septic tanks were disposed of through leach lines	Soil, groundwater	NFA
15	R-Range Septic System (Water Road) (Buildings 31434, 31440, 31433, and 31439)	Industrial and sanitary wastes from a lab were discharged to a surface ditch and leach field	Soil, groundwater	RI/FS
16	G-1 Range Septic System (Building 30881)	Sanitary and lab wastes were disposed of through leach lines	Soil, groundwater	NFA
17	G-2 Range Septic System (Building 30994)	Sanitary, explosive, and photo lab wastes were disposed of through leach lines	Soil, groundwater	NFA

Site	Site Name	Cause of Contamination	Medium	Status*
18	China Lake Propulsion Labs Leach Fields (Buildings 11050, 13040, and 14000)	Sanitary and industrial wastes, including PEP and photo lab wastes, were disposed of in leach fields	Soil	RI/FS
19	Baker Range Waste Trenches	Miscellaneous range wastes were disposed of in one large slit trench	Soil	NFA
20	Division 36 Ordnance Waste Area	Miscellaneous range wastes were disposed of in two slit trenches	Soil	NFA
21	CT-4 Disposal Area	Hazardous wastes from weapons testing were disposed of in a slit trench	Soil	NFA
22	Pilot Plant Road Landfill	Wastes from Navy housing and Public Works were disposed of in 12 trenches	Soil, groundwater	RI/FS
23	K-2 South Disposal Area	Range wastes and possibly chlordane were disposed of in three slit trenches	Soil	NFA
24	K-2 North Disposal Area	Range wastes were disposed of in two slit trenches	Soil	NFA
25	G-2 Range Disposal Area	Miscellaneous range wastes were disposed of in three slit trenches	Soil	NFA
26	G-2 Range Ordnance Waste Area	Miscellaneous range wastes were disposed of in two slit trenches	Soil	NFA
27	NAF Disposal Site	Solid and liquid wastes from aircraft operations were disposed of in two slit trenches	Soil, groundwater	NFA
28	Old DPDO Storage Yard	Possible spills of PCBs from leaking transformers; no evidence of spills found	Soil	NFA
29	C-1 Range East Disposal Area	Range wastes, chlordane and possibly unexploded ordnance were disposed of in three trenches	Soil	RI/FS
30	C-1 Range West Disposal Area	Range wastes and possibly unexploded ordnance were disposed of in two trenches	Soil	NFA
31	Public Works Pesticide Rinse Area	Pesticide- and herbicide-contaminated rinse waters were spilled on the ground	Soil	RI/FS & removal
32	Golf Course Pesticide Rinse Area (Building 02333)	Pesticide- and herbicide-contaminated rinse waters were spilled on the ground	Soil	RI/FS & removal
33	Michelson Lab Dry Wells (Building 00005)	Small amounts of fluid from pack-up power batteries were spilled or drained into dry wells	Soil, possible groundwater	RI/FS
34	Lauritsen Road Landfill	Inert and hazardous wastes were disposed of in several large trenches	Soil	NFA
35	SNORT Track Accident	A small amount of beryllium-contaminated materials were buried at this site	Soil	NFA
36	SNORT Storage Sheds (Buildings 20100, 25008, 25009, 25028, and 25021)	Several small spills of hazardous materials occurred in small storage sheds	Soil	NFA
37	Golf Course Landfill	Waste from the general China Lake community was disposed of in this small landfill	Soil	NFA
38	Cactus Flat Disposal Trenches	Wastes from special test programs were disposed of in two small trenches	Soil	NFA
39	CGEH-1 Geothermal Waste	Drilling mud and oil wastes were disposed of in an open pit	Soil	NFA
40	Randsburg Wash #1 (South Range)	Range wastes were disposed of in three slit trenches	Soil	NFA
41	Randsburg Wash #2 (South Range)	General and hazardous wastes were disposed of in two large pits	Soil	NFA
42	Randsburg Wash #3 (South Range)	One-time disposal of 30 drums of fuel, which was burned in the drums	Soil	NFA
43	Minideck (Building 31164)	Firefighting chemicals and unburned jet fuel were discharged into an unlined pond	Groundwater, soil	RI/FS

Site	Site Name	Cause of Contamination	Medium	Status*
44	Armitage Field Fire Fighting Training Area	Firefighting chemicals and unburned jet fuel spilled off the paid and several pits were used for disposal of fuels	Soil	RI/FS
45	NAF Maintenance Area	Aircraft maintenance wastes were disposed of in an unlined ditch	Soil	RI/FS
46	Dunkit Drainage Ditch (Building 15950)	Wastewater and chemicals from rocket motor casing cleaning were discharged into an unlined ditch.	Soil	RI/FS
48	Weapons Survivability Holding Ponds (Bldg. 31169, 73118 and 31179)	Petroleum hydrocarbons	Soil	NFA
47	Michelson Lab Sewer System (Building 00005)	Industrial wastewater from the Public Works compound and Michelson Lab were discharged to lined ponds	Groundwater	Removal & RI/FS
49	Salt Wells Propulsion Lab Industrial Waste Ponds and Sumps	Rinse water from various activities involved in propellant and explosive research was disposed of in ponds and sumps	Groundwater, soil	Removal
50	Airplane Oil Disposal Trench (Buildings 20220 and 20250)	Waste engine oil was disposed of in a trench	Soil	Removal
51	Area R East (Building 31531)	Vehicle maintenance, hazardous materials storage, and inert waste disposal trenches may have resulted in ground contamination	Soil	Removal
52	Area R Warhead Firing Arena (Building 31588)	No evidence of waste disposal	None	NFA
53	Area R Laser Lab Leachline (Building 31516)	Sanitary wastes were disposed of in a leach field	Soil	NFA
55	Area R Solvent Rinse Tank and Vicinity (Buildings 31503, 31504, and 31562)	Contaminated fluids may have escaped from the solvent rinse tank	Soil	RI/FS
56	Area R Static Firing Rocket Test Stands (Buildings 31505, 31568, 31569, and 31615)	Mercury, and possibly acids, bleaches, and unidentified chlorinated solvents were released during the test firings of liquid propellant rockets	Air, soil	Removal
57	Area R Warhead Research Pit (Building 31600)	Construction debris was dumped in this area	Soil	NFA
58	Armitage Field VX-5 Line Shack Storage Area (Building 00031)	Asphalt appears contaminated from the storage of hazardous hydraulic fluid, oil, jet fuel, and solvents	Soil	Removal
59	B-2 Spotting Tower 3 Quonset Hut (Buildings 30069 and 30072)	Area was used as a storage yard for the aircraft tire and brake shop	Soil	NFA
60	B-2 Spotting Tower 3 Quonset Hut (Buildings 30069 and 30072)	Range wastes may have been dumped in this area	Soil	NFA
61	B-3 Tower Dump	Range wastes were disposed of in a small trench	Soil	NFA
62	B-4 Start-Up Area (Buildings 30144 and 30145)	Wastewater from range operations was discharged to a septic system and dry well	Soil, possible groundwater	Removal
63	Dempsey Dumpster Station	Rinse water from dumpster cleaning	Soil	NFA
64	Earth & Planetary Sciences Leach Fields (Buildings 31567 and 31568)	Industrial wastewater was discharged to a septic system	Soil	RI/FS
65	G-2 Range Gun Mounts (Near Building 30964)	Guns were cleaned in the area	Soil	NFA
66	HANS Test Site (Building 32543)	Jet fuel was used in burn tests on composite materials, especially carbon fibers	Soil	NFA
67	Flightlines Lane Haven Dump	Solid waste from a mobile home park was disposed of in this area	Soil	NFA
68	Public Works Old PCB Transformer Storage Area	Possible PCB leakage	Soil	NFA
69	Public Works Vehicle Paint Shop & Drainage Catch Basin (Buildings 00576 and 02664)	Contaminants from Public Works paint shop activities, such as paint and solvents, drained into the surface runoff collection basin	Groundwater, soil	RI/FS

Site	Site Name	Cause of Contamination	Medium	Status*
70	Public Works Tank Truck Dry Well (Buildings 01088 and 02622)	Although this facility was constructed for de-fueling tanker trucks, there is no evidence that it was used for this purpose, but it was used for washing trucks	Soil, possible groundwater	RI/FS
71	Public Works Heavy Duty Equipment Repair Shop Storage Area	Hazardous materials stored in this area may have spilled or leaked	Soil	NFA
72	Railroad Engine House (Building 1055)	Waste oil from diesel locomotives was discharged into a concrete-lined pit that drained into a dry well	Soil, possible groundwater	RI/FS
73	Randsburg Wash Black Powder Assembly Building (Building 7007) (South Range)	Wastewater from black powder handling activities may have been discharged into floor drains	Soil	NFA
74	Randsburg Wash Central Site Old Leach Field (Buildings 70001, 70002, 70003, 70004, 70005, and 70006) (South Range)	Industrial wastewater from a photo lab, and maintenance and machine shops was discharged to a septic system	Soil	NFA
75	Randsburg Wash Gas Station (Building 70005) (South Range)	Vehicle maintenance activities	Soil	NFA
76	Randsburg Wash Gun Line (Buildings 70024, 70025, and 70031) (South Range)	Gun cleaning operations	Soil	NFA
77	Sludge Pit (Water Road)	Road oil was disposed of in a pit	Soil	NFA
78	SNORT Old Photographic Lab Sumps (Building 25010)	Photo processing wastes were discharged to a sump	Groundwater, soil	NFA
80	POI small locations	Various operation activities	Soil	PA

Notes:
In preparing this table, Site 79 was erroneously included. Initial investigations at Site 79 performed between 1999 and 2000 found that no releases of hazardous substances occurred, only the use of ordnance for its intended purpose. The site has been removed from the NAWS-CL Restoration Program and instead will continue to be managed as an active range.
*Removal = recommended for interim removal actions
RI = Remedial Investigation; FS = Feasibility Study; NFA = Navy recommendation for no further action subject to approval by the state agencies; PA = Preliminary Assessment



Map H-1. Installation restoration sites at NAWS China Lake.

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H.2 Approved Pesticide List

Integrated Pest Management Plan (2008)

(See Appendix E Table of Contents)

To ensure this list has contains the most updated information, please refer to the Integrated Pest Management Coordinator on Station. This individual will have access to the online system where the authorized use list will be maintained.

E-1 Approved Pesticides - Pestmaster Services, Inc. (BOSC Pest Control and Grounds Maintenance)

E-2 Approved Pesticides - Pestmaster Services, Inc. (PPV Housing - Lincoln Military Housing)

E-3 Approved Pesticides - Morale, Welfare and Recreation (MWR) Golf Course

Federal law requires comprehensive regulation of the manufacture, transport, storage, and use of pesticides. The U.S. Environmental Protection Agency, in cooperation with state and local agencies, implements the basic federal regulatory framework governing pesticides under the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA; 40 Code of Federal Regulations § 152 et seq). This law initially was enacted in 1947 and has been amended several times, most recently in 1996. The FIFRA of 1972 requires the registration and classification of pesticides and prescribes controls over their application and use. California's pesticide laws that are contained in California Code of Regulations Title 3, Chapter 4, incorporate the FIFRA federal standards and definitions and provide additional detailed state regulations that complement FIFRA.

California Code of Regulations

(Title 3. Food and Agriculture) Division 6. Pesticides and Pest Control Operations; Chapter 2. Pesticides, Subchapter 4. Restricted Materials, Article 1. Restricted Materials, 6400. Restricted Materials)

The director designates the pesticides listed in this section as restricted materials.

- Any pesticide labeled as a "Restricted Use Pesticide" pursuant to Section 3 of the FIFRA (Title 7, U.S. Code § 136a).
- Any pesticide used under an "Emergency Exemption" issued pursuant to Section 18 of the FIFRA (Title 7, U.S. CodeSC § 136p).
- Pesticides formulated as a dust, labeled to permit outdoor use, and packaged in containers of more than 25 pounds, except:
  1. Products containing only exempt materials specified in § 6402; and
  2. Products containing only carbaryl, disulfoton, endosulfan, lindane, strychnine, zinc phosphide or an active ingredient not otherwise included in this Section, and labeled only for one or more of the following uses: home use, structural pest control, industrial use, institutional use, and use by public agency vector control districts pursuant to § 2426 of the Health and Safety Code.
- Pesticide products containing active ingredients listed in § 6800(a) (Potential to Pollute Groundwater), when labeled for agricultural, outdoor institutional, or outdoor industrial use. (see Page 62 for reference to active ingredients that have potential to pollute groundwater.)
- Certain other pesticides:
  - ACROLEIN, when labeled for use as an aquatic herbicide

- ALDICARB (Temik)
- ALUMINUM PHOSPHIDE (Phostoxin)
- 4-AMINO PYRIDINE (Avitrol)
- AZINPHOS-METHYL (Guthion)
- CALCIUM CYANIDE
- CARBARYL (Sevin), except:
  1. When formulated as a bait; or
  2. When labeled only for one or more of the following uses: use directly on livestock or poultry, home use, structural pest control, industrial use, institutional use, or use by public agency vector control districts pursuant to § 2426 of the Health and Safety Code.
- CARBOFURAN (Furadan)
- CHLOROPICRIN
- 3-CHLORO-P-TOLUIDINE HYDROCHLORIDE (Starlicide)
- DAZOMET (Basamid), when labeled for the production of agricultural plant commodities.
- DICAMBA (Banvel), except:
  1. Liquid formulations packaged in containers of one quart or less regardless of percentage of dicamba;
  2. Liquid formulations that contain 15% or less dicamba packaged in containers of 1 gallon or less;
  3. Liquid formulations of a product that is labeled to be used without further dilution;
  4. Dry formulations, packaged in containers of 1 pound or less, of a product that is labeled to be further diluted for use; and
  5. Dry formulations, packaged in containers of 50 pounds or less, of a product that contains 10% or less dicamba and is labeled to be used without further dilution.
- 2,4-DICHLOROPHENOXYACETIC ACID (2,4-D), except:
  1. Liquid formulations, packaged in containers of 1 quart or less, regardless of percentage of 2,4-D;
  2. Liquid formulations that contain 15% or less 2,4-D packaged in containers of 1 gallon or less;
  3. Liquid formulations of a product that is labeled to be used without further dilution;
  4. Dry formulations, packaged in containers of 1 pound or less, regardless of percentage of 2,4-D;
  5. Dry formulations, packaged in containers of 50 pounds or less, of a product that contains 10% or less 2,4-D and is labeled to be used without further dilution; and
  6. Products labeled only for use as a plant growth regulator.
- 2,4-DICHLORPHENOXYBUTYRIC ACID (2,4-DB), except:
  1. Liquid formulations, packaged in containers of 1 quart or less, regardless of percentage of 2,4-DB;
  2. Liquid formulations that contain 15% or less 2,4-DB packaged in containers of 1 gallon or less;
  3. Liquid formulations of a product that is labeled to be used without further dilution;
  4. Dry formulations, packaged in containers of 1 pound or less, regardless of percentage of 2,4-DB; and
  5. Dry formulations, packaged in containers of 50 pounds or less, of a product that contains 10% or less 2,4-DB and is labeled to be used without further dilution.
- 2,4-DICHLOROPHENOXYPROPIONIC ACID (2,4-DP), except:
  1. Liquid formulations, packaged in containers of 1 quart or less, regardless of percentage of 2,4-DP;

2. Liquid formulations that contain 15% or less 2,4-DP packaged in containers of 1 gallon or less;
3. Liquid formulations of a product that is labeled to be used, without further dilution of 2,4-DP;
4. Dry formulations, packaged in containers of 1 pound or less, regardless of percentage of 2,4-DP;
5. Dry formulations, packaged in containers of 50 pounds or less, of a product that contains 10% or less 2,4-DP and is labeled to be used without further dilution.

- 1,3-DICHLOROPROPENE (Telone II)
- DISULFOTON (Di-Syston), except when labeled only for one or more of the following uses; home use, structural pest control, industrial use, institutional use, and use by public agency vector control districts pursuant to § 2426 of the Health and Safety Code.
- ENDOSULFAN (Thiodan), except when labeled only for one or more of the following uses: home use, structural pest control, industrial use, institutional use, and use by public agency vector control districts pursuant to § 2426 of the Health and Safety Code. (Reference: §§ 14004.5 and 14005, Food and Agricultural Code.)
- ETHOPROP (Mocap), when labeled for turf use.
- FENAMIPHOS (Nemacur)
- LINDANE, except when labeled only for one or more of the following uses: home use, structural pest control, industrial use, institutional use, and use by public agency vector control districts pursuant to § 2426 of the Health and Safety Code.
- METAM SODIUM, labeled for the production of agricultural plant commodities.
- METHAMIDOPHOS (Monitor)
- METHIDATHION (Supracide)
- METHOMYL (Lannate), except fly baits containing not more than one percent methomyl.
- METHYL BROMIDE
- 2-METHYL-4-CHLOROPHENOXYACETIC ACID (MCPA), except:
  1. Liquid formulations packaged in containers of 1 quart or less regardless of percentage of MCPA;
  2. Liquid formulations that contain 15% or less MCPA packaged in containers of 1 gallon or less;
  3. Liquid formulations of a product that is to be used without further dilution;
  4. Dry formulations, packaged in containers of 1 pound or less, regardless of percentage of MCPA; and
  5. Dry formulations, packaged in containers of 50 pounds or less, of a product that contains less than 10% MCPA and is labeled to be used without further dilution.
- METHYL ISOTHIOCYANATE, labeled for the production of agricultural plant commodities.
- MEVINPHOS (Phosdrin)
- MOLINATE (Ordram)
- OXYDEMETON-METHYL (Metasystox-R)
- PARAQUAT (Gramoxone)
- PARATHION-METHYL
- PHORATE (Thimet)
- POTASSIUM N-METHYLDITHIOCARBAMATE (metam-potassium), when labeled for the production of agricultural plant commodities.
- PROPANIL (3, 4-Dichloropropionanilide)

- SODIUM CYANIDE
- SODIUM FLUOROACETATE (Compound 1080)
- SODIUM TETRATHIOCARBONATE (Enzone)
- STRYCHNINE, except rodenticides when labeled only for one or more of the following uses: home use, structural pest control, industrial use, institutional use, and use by public agency vector control districts pursuant to § 2426 of the Health and Safety Code.
- SULFOTEPP
- SULFURYL FLUORIDE
- THIOBENCARB (Bolero)
- TRIBUFOS (DEF, Folex)
- TRIBUTYLTIN, organotin, or a tri-organotin compound formulated as an antifouling paint, coating or compound and labeled for the control of fouling organisms in an aquatic environment.
- ZINC PHOSPHIDE, except when labeled only for one or more of the following uses: home use, structural pest control, industrial use, institutional use, and use by public agency vector control districts pursuant to § 2426 of the Health and Safety Code. (Authority: §§ 14004.5 and 14005, Food and Agricultural Code.)

6402. Exempt Materials

The director designates and establishes, pursuant to § 14006.7 of the Food and Agricultural Code, the pesticides stated in this Section as exempt materials (Authority: § 11456 and 14006.7, Food and Agricultural Code).

- Spray adjuvants
- Petroleum oils
- Sulfur
- Lime
- Lime-sulfur
- Sodium polysulfide
- Certain copper compounds
  - Bordeaux mixture
  - Copper acetate
  - Copper carbonate
  - Copper hydroxide
  - Copper-lime mixtures
  - Copper linoleate
  - Copper oleate
  - Copper oxychloride
  - Copper sulfate (basic, monhydrate, and pentahydrate)
  - Copper oxide
  - Copper calcium oxychloride
- Bacillus thuringiensis Berliner

Appendix I: Species List

Table I-1. Convention on International Trade in Endangered Species of Wild Fauna and Flora-listed animals in the United States that occur at Naval Air Weapons Station China Lake (www.cites.org 2012).

Scientific Name	Common Name
Angiosperms-Dicots: Family Cactaceae	
Echinocactus polycephalus var. *polycephalus*	cottontop cactus
Echinocereus englemanii var. *chrysocentrus*	hedgehog cactus
Mammillaria tetrancistra	fish hook cactus
Opuntia basilaris var. *basilaris*	beavertail cactus
Opuntia echinocarpa	golden cholla
Opuntia erinacea var. *erinacea*	Mojave prickly pear
Opuntia erinacea var. *ursina*	grizzly bear cactus
Opuntia ramosissima	branched pencil cholla
Sclerocactus polyancistrus	Mojave fishhook cactus
Angiosperms-Monocots: Family Orchidaceae	
Epipactis gigantea	stream orchid
Order Testudinata: Family Testudinidae	
Gopherus agassizii	Mohave Desert Tortoise
Order Squamata: Family Boidae	
Lichanura trivirgata	Rosy Boa
Order Accipitriformes: Family Pandionidae	
Pandion haliaetus	osprey
Order Accipitriformes: Family Accipitridae	
Accipiter cooperii	Cooper's hawk
Accipiter gentilis	northern goshawk
Accipiter striatus	sharp-shinned 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
Order Falconiformes: Family Falconidae	
Falco columbarius	merlin
Falco mexicanus	prairie falcon
Falco peregrinus	Peregrine falcon
Falco sparverius	American kestrel
Order Anseriformes: Family Anatidae	
Branta canadensis	Canada goose
Order Gruiformes: Family Gruidae	
Grus canadensis	sandhill crane
Order Strigiformes: Family Tytonidae	
Tyto alba	barn owl

Scientific Name	Common Name
Order Strigiformes: Family Strigidae	
Aegolius acadicus	northern saw-whet owl
Asio flammeus	short-eared owl
Asio otus	long-eared owl
Athene cunicularia	burrowing owl
Bubo virginianus	great horned owl
Glaucidium gnoma	northern pygmy owl
Otus flammeolus	flammulated owl
Order Apodiformes: Family Trochilidae	
Archilochus alexandrii	black-chinned hummingbird
Calypte anna	Anna's hummingbird
Calypte costae	Costa's hummingbird
Cynanthus latirostris	broad-billed hummingbird
Selasphorus calliope	calliope hummingbird
Selasphorus platycercus	broad-tailed hummingbird
Selasphorus rufus	rufous hummingbird
Selasphorus sasin	Allen's hummingbird
Order Carnivora: Family Fedlidae	
Lynx rufus	bobcat
Order Artiodactyla: Family Bovidae	
Ovis canadensis	bighorn sheep

I.1 Plants Known to Occur or Likely to Occur at NAWS China Lake

Nomenclature follows Hickman 1993 or the California Native Plant Society 2011 Inventory of Rare Plants.

Data Sources: Species list is compiled from the previous Integrated Natural Resources Management Plan and records by Gordon Pratt, unless otherwise noted:

- Other Sources: California Natural Diversity Database records.
- Species classified as invasive weeds by the California Invasive Plant Council.

PTERIDOPHYTES (FERNS)

Family Pteridaceae
Cheilanthes covillei–Coville's lip fern
Cheilanthes parryi–Parry's lip fern
Cheilanthes viscida–viscid lace fern
Pellaea mucronata var. *californica*–bird's-foot fern
Pentagramma triangularis subsp. *triangularis*–goldback fern

GYMNOSPERMS (CONIFERS)

Family Cupressaceae
Juniperus osteosperma–Utah juniper

Family Ephedraceae
Ephedra aspera–boundary ephedra
Ephedra funerea–Death Valley ephedra
Ephedra nevadensis–Nevada ephedra
Ephedra viridis–green ephedra

Family Pinaceae
Pinus monophylla–singleleaf pinyon pine

CERATOPHYLLALES (HORN WORT)

Family Ceratophyllaceae
Ceratophyllum demersum–hornwort

EUDICOTS (FLOWERING PLANTS)

Family Adoxaceae
Sambucus nigra subsp. *caerulea*–blue elderberry

Family Amaranthaceae
Amaranthus albus–tumbleweed
Nitrophila occidentalis–boraxweed
Tidestromia suffruticosa var. *oblongifolia*–honeysweet

Family Apiaceae
Berula erecta–cutleaf water-parsnip
Cymopterus aboriginum–Indian springparsley
Cymopterus deserticola–desert cymopterus
Cymopterus panamintensis var. *panamintensis*–Panamint springparsley
Cymopterus ripleyi–Ripley's cymopterus
Lomatium mohavense–Mojave lomatium
Lomatium nevadense var. *parishii*–Parish's lomatium
Lomatium utriculatum–common lomatium

Family Apocynaceae
Apocynum cannabinum–Indian hemp
Asclepias erosa–desert milkweed
Asclepias fascicularis–narrow-leaf milkweed
Asclepias vestita–woolly milkweed
Funastrum hirtellum–trailing townula

Family Asteraceae
Acamptopappus sphaerocephalus–rayless goldenhead
Adenophyllum cooperi–Cooper's dyssodia
Ambrosia acanthicarpa–annual bur-sage
Ambrosia dumosa–white bur-sage
Ambrosia salsola var. *salsola*–common burrobush, cheesebush
Amphipappus fremontii–chaffbush
Aniscoma acaulis–scalebud
Arida carnosa–shrubby alkali aster
Artemisia douglasiana–mugwort
Artemisia drancunulus–tarragon
Artemisia ludoviciana subsp. *albula*–silver wormwood
Artemisia ludoviciana subsp. *ludoviciana*–silver wormwood
Artemisia nova–black sagebrush
Artemesia spinescens–budsage
Artemisia tridentata–big sagebrush
Atrichoseris platyphylla–gravel-ghost
Baccharis brachyphylla–shortleaf baccharis
Baccharis salicifolia subsp. *salicifolia*–mulefat
Baccharis sergiloides–desert baccharis
Bahiopsis reticulata–valley goldeneye
Baileya pleniradiata–woolly marigold
Bebbia juncea var. *aspera*–sweetbush
Brickellia atractyloides var. *arguta*–pungent brickellbush
Brickellia califomica–California brickellbush
Brickellia desertorum–desert brickellbush
Brickellia longifolia var. *multiflora*–longleaf brickellbush
Brickellia microphylla–littleleaf brickellbush
Brickellia oblongifolia var. *linifolia*–narrowleaf brickellbush
Calycoseris parryi–yellow tack-stem
Calycoseris wrightii–white tack-stem
Centaurea solstitialis–yellow star-thistle
Chaenactis carphoclinia var. *carphoclinia*–pebble pincushion
Chaenactis douglasii var. *douglasii*–dusty-maidens
Chaenactis fremontii–Fremont pincushion
Chaenactis macrantha–Mojave pincushion
Chaenactis stevioides–desert pincushion
Chaenactis xantiana–fleshy pincushion
Chrysothamnus viscidiflorus subsp. *puberulus*–yellow rabbitbrush, sticky-leaved rabbitbrush
Chrysothamnus viscidiflorus subsp. *viscidiflorus*–yellow rabbitbrush, sticky-leaved rabbitbrush
Cichorium sp.–chicory
Cirsium mohavense–Mojave thistle
Cirsium neomexicanum–desert thistle
Cirsium occidentale–western thistle
Crepis occidentalis–western hawksbeard
Dicoria canescens–desert dicoria
Dieteria canescens–hoary aster
Dieteria canescens var. *canescens*–hoary-aster
Encelia actoni–Acton's encelia
Encelia actoni X E. farinosa–brittlebush

Encelia farinosa–brittlebush
Encelia frutescens–button brittlebush
Ericameria cooperi–Cooper's goldenbush
Ericameria cooperi var. *cooperi*–Cooper's goldenbush
Ericameria cooperi X lineaifolia–goldenbush natural hybrid
Ericameria cuneata–wedgeleaf goldenbush
Ericameria linearifolia–interior goldenbush
Ericameria nauseosa var. *oreophila*–Great Basin rabbitbrush
Ericameria nauseosa var. *hololeuca*–white rabbitbrush
Ericameria nauseosa var. *mohavensis*–Mojave rabbitbrush
Ericameria paniculata–black-banded rabbitbrush
Ericameria teretifolia–green rabbitbrush, round-leaf rabbitbrush
Erigeron aphanactis–rayless shaggy fleabane
Erigeron breweri var. *covillei*–Coville's fleabane
Erigeron breweri var. *porphyreticus*–Brewer's fleabane
Erigeron canadensis–horseweed
Eriophyllum ambiguum–woolly sunflower
Eriophyllum mohavense–Barstow woolly sunflower
Eriophyllum pringlei–Pringle's woolly sunflower
Eriophyllum wallacei–Wallace's woolly daisy
Geraea canescens–desert-sunflower
Glyptopleura marginata–carveseed
Gnaphalium palustre–cudweed
Gutierrezia microcephala–sticky snakeweed
Gutierrezia sarothrae–matchweed
Hecastocleis shockleyi–prickleleaf
Heliomeris multiflora var. *nevadensis*–Nevada goldeneye
Hulsea heterochroma–red-rayed hulsea
Hulsea vestita subsp. *inyoensis*–Inyo hulsea
Isocoma acradenia–alkali goldenbush
Iva axillaris–poverty weed
Lactuca serriola–prickly lettuce
Laennecia coulteri –Coulter's horseweed
Lasthenia californica–goldfields
Lasthenia microglossa–small-ray goldfields
Layia glandulosa–white layia
Lepidospartum squamatum–scale-broom
Leptosyne bigelovii–Bigelow coreopsis
Lessingia glandulifera var. *glandulifera*–valley lessingia
Logfia arizonica–Arizona cottonrose
Logfia depressa–hierba limpia
Malacothrix coulteri–snake's-head
Malacothrix glabrata–desert dandelion
Malacothrix sonchoides–sowthistle desert dandelion
Malacothrix stebbinsii–Stebbins desert dandelion
Matricaria discoidea–pineapple weed, rayless chamomile
Matricaria occidentalis–valley mayweed
Monoptilon bellidiforme–desert star
Monoptilon bellioides–desert star
Nicolletia occidentalis–hole-in-the-sand plant
Palafoxia arida var. *arida*–desert needle
Perityle emoryi –Emory's rock daisy
Perityle megalocephala var. *oligophylla*–small-leaved rockdaisy
Peucephyllum schottii–pygmy-cedar
Pleiacanthus spinosa–thorn skeletonweed
Pleurocoronis pluriseta–arrowleaf
Pluchea odorata–saltmarsh-fleabane
Pluchea sericea–arrow-weed
Prenanthella exigua–brightwhite
Psathyrotes annua–annual psathyrotes
Psathyrotes ramosissima–turtleback
Pseudognaphalium beneolens–cudweed, everlasting
Pseudognaphalium luteoalbum–cudweed, everlasting
Pseudognaphalium stramineum–cudweed, everlasting
Rafinesquia californica–California chicory
Rafinesquia neomexicana–desert chicory
Senecio flaccidus var. *monoensis*–smooth threadleaf ragwort
Solidago confinus–southern goldenrod
Solidago spectablis–showy goldenrod
Sonchus asper subsp. *asper*–prickly sow thistle
Stephanomeria exigua subsp. *exigua*–small wire-lettuce
Stephanomeria parryi–Parry's wire-lettuce
Stephanomeria pauciflora–wire-lettuce
Stylocline gnaphaloides–everlasting neststraw
Stylocline micropoides–desert neststraw
Symphyotrichum frondosum–short-rayed alkali aster
Syntrichopappus fremontii–Fremont's syntrichopappus
Tetradymia axillaris var. *axillaris*–longspine horsebrush
Tetradymia axillaris var. *longispina*–longspine horsebrush
Tetradymia canescens–spineless horsebrush

Tetradymia glabrata–littleleaf horsebrush
Tetradymia stenolepis–Mojave horsebrush
Townsendia scapigera–tufted townsendia
Uropappus lindleyi–silverpuffs
Xylorhiza tortifolia var. *tortifolia*–Mojave-aster

Family Boraginaceae
Amsinckia intermedia–common fiddleneck
Amsinckia tessellata–fiddleneck
Amsinckia vernicosa–waxy fiddleneck
Cryptantha angustifolia–
narrow-leaved cryptantha
Cryptantha barbigera–bearded cryptantha
Cryptantha circumscissa–cushion cryptantha
Cryptantha clokeyi–Clokey's cryptantha
Cryptantha confertiflora–
yellow-flowered cryptantha
Cryptantha decipiens–gravel cryptantha
Cryptantha dumetorum–scrambling cryptantha
Cryptantha echinella–hedgehog cryptantha
Cryptantha gracilis–slender cryptantha
Cryptantha holoptera–winged cryptantha
Cryptantha intermedia–common cryptantha
Cryptantha maritima–Guadalupe cryptantha
Cryptantha micrantha–purple-root cryptantha
Cryptantha muricata–
showy prickly-nut cryptantha
Cryptantha nevadensis–Nevada cryptantha
Cryptantha pterocarya var. *cycloptera*–
Tuscon cryptantha
Cryptantha pterocarya var. *pterocarya*–
winged-nut cryptantha
Cryptantha racemosa–shrubby cryptantha
Cryptantha recurvata–curved-nut cryptantha
Cryptantha scoparia–gray cryptantha
Cryptantha utahensis–scented cryptantha
Heliotropium curassavicum var. *oculatum*–
seaside heliotrope, alkali heliotrope
Pectocarya penicillata–northern pectocarya
Pectocarya platycarpa–wide-toothed pectocarya
Pectocarya recurvata–arched-nut pectocarya
Pectocarya setosa–round-nut pectocarya
Plagiobothrys arizonicus–Arizona popcornflower
Plagiobothrys canescens–valley popcornflower
Plagiobothrys jonesii–Mojave popcornflower
Plagiobothrys leptocladus–alkali plagiobothrys
Tiquilia plicata–fan-leaved tiquilia

Family Brassicaceae
Boechera dispar–pinyon rockcress
Boechera glaucovalvula–bluepod rockcress
Boechera inyoensis–Inyo rockcress
Boechera lincolnensis–Lincoln rockcress
Boechera perennens–perennial rockcress
Boechera pulchra–beautiful rockcress
Boechera sparsiflora–sicklepod rockcress
Boechera xylopoda–bigfoot hybrid rockcress
Brassica nigra–black mustard
Brassica tournefortii–Saharan mustard
Caulanthus cooperi–Cooper's jewelflower
Caulanthus coulteri–Coulter's jewelflower
Caulanthus crassicaulis var. *crassicaulis*–
thick-stemmed wild cabbage
Caulanthus inflatus–desert candle
Caulanthus pilosus–chocolate drops
Descurainia pinnata–Tansy mustard
Descurainia sophia–flixweed
Dithyrea californica–spectacle-pod
Draba cuneifolia–desert draba
Erysimum capitatum subsp. *capitatum*–wallflower
Guillenia lasiophylla–California mustard
Halimolobos jaegeri–rock mustard
Hesperidanthus jaegeri–Jaeger's hesperidanthus
Hornungia procumbens–prostrate hutchinsia
Lepidium didymum–lesser swine cress
Lepidium flavum–yellow pepperweed
Lepidium fremontii–desert pepperweed
Lepidium lasiocarpum subsp. *lasiocarpum*–
shaggyfruit pepperweed
Nasturtium officinale–water cress
Rorippa sinuata–spreading yellow cress
Sibara deserti–desert winged rockcress
Sisymbrium altissimum–tumble mustard
Sisymbrium irio–London rocket
Stanleya elata–prince's plume
Stanleya pinnata var. *pinnata*–prince's plume
Streptanthella longirostris–stryptanthella
Thysanocarpus curvipes–fringepod
Thysanocarpus laciniatus–mountain fringepod
Tropidocarpum gracile–slender tropidocarpum

Family Cactaceae
Cylindropuntia echinocarpa–golden cholla
Cylindropuntia ramosissima–diamond cholla,
pencil cactus
Echinocactus polycephalus var. *polycephalus*–
barrel cactus
Echinocereus englemanii–hedgehog cactus
Mammillaria tetrancistra–fishhook cactus
Opuntia basilaris var. *basilaris*–beavertail cactus
Opuntia polyacantha var. *erinacea*–
Mohave prickly pear, grizzly bear cactus

Sclerocactus polyancistrus–Mohave fishhook cactus

Family Campanulaceae
Nemacladus glanduliferus var. *orientalis*–eastern glandular nemacladus
Nemacladus rubescens–desert nemacladus
Nemacladus sigmoideus–small-flowered nemacladus

Family Caprifoliaceae
Symphoricarpos longiflorus–fragrant snowberry

Family Caryophyllaceae
Achyronychia cooperi–onyx flower, frost-mat
Eremogone kingii var. *glabrescens*–King's sandwort
Eremogone ferrisiae–Ferris' sandwort
Eremogone macradenia–desert sandwort
Eremogone macradenia var. *macradenia*–desert sandwort
Silene verecunda–San Francisco campion
Spergularia bocconii–Boccone's sand-spurrey
Spergularia marina–saltmarsh sand-spurrey

Family Chenopodiaceae
Allenrolfea occidentalis–iodine bush
Atriplex canescens–four-wing saltbush
Atriplex confertifolia–shadscale
Atriplex covillei–Coville's orach
Atriplex hymenelytra–desert-holly
Atriplex lentiformis–big saltbush
Atriplex torreyi subsp. *torreyi*–Torrey's saltbush
Atriplex parryi–Parry's saltbush
Atriplex polycarpa–allscale saltbush
Atriplex rosea–tumbling orach
Atriplex spinifera–spiny saltbush
Atriplex torreyi subsp. *torreyi*–Torrey's saltbush
Bassia hyssopifolia–fivehook bassia
Chenopodium californicum–California goosefoot
Chenopodium fremontii–Fremont's goosefoot
Chenopodium incanum var. *occidentale*–western goosefoot
Chenopodium pratericola–desert goosefoot
Chenopodium rubrum–red pigweed
Dysphania botrys–Jerusalem-oak
Grayia spinosa–hop-sage
Kochia americana–green molly
Kochia californica–rusty molly
Kochia scoparia–common red sage
Krascheninnikovia lanata–winterfat
Monolepis nuttalliana–Nuttall's poverty weed
Salicornia pacifica–Pacific swampfire
Salsola paulsenii–barbwire Russian thistle
Salsola tragus–Russian thistle, tumbleweed
Suaeda nigra–bush seepweed

Family Cleomaceae
Cleomella brevipes–short-pedicelled cleomella
Cleomella obtusifolia–Mohave stinkweed
Cleomella parviflora–slender cleomella
Oxystylis lutea–spiny caper
Peritoma arborea–bladderpod

Family Convolvulaceae
Cuscuta denticulata–small-toothed dodder
Cuscuta indecora–large-seeded dodder
Cuscuta nevadensis–Nevada dodder
Cuscuta salina–salt dodder

Family Crassulaceae
Dudleya saxosa subsp. *saxosa*–Panamint dudleya

Family Crossosomataceae
Glossopetalon spinescens–Nevada greasewood

Family Cucurbitaceae
Cucurbita palmata–coyote melon

Family Euphorbiaceae
Chamaesyce albomarginata–rattlesnake weed
Chamaesyce micromera–desert spurge
Chamaesyce ocellata var. *arenicola*–sand spurge
Chamaesyce polycarpa–small-seeded spurge
Chamaesyce setiloba–Yuma spurge
Chamaesyce vallis-mortae–Death Valley sandmat
Croton setigerus–turkey-mullein
Stillingia paucidentata–Mohave stillingia
Stillingia spinulosa–annual stillingia

Family Fabaceae
Acmispon americanus var. *americanus*–Spanish lotus
Acmispon brachycarpus–short-podded lotus
Acmispon nevadensis var. *nevadensis*–Sierra Nevada lotus
Acmispon maritimus var. *brevivexillus*–coastal lotus
Acmispon procumbens var. *procumbens*–silky California lotus
Acmispon rigidus–desert lotus
Acmispon strigosus–strigose lotus
Acmispon wrangelianus–Chilean trefoil
Astragalus acutirostris–sharpkeel milkvetch
Astragalus atratus var. *mensanus*–Darwin Mesa milkvetch
Astragalus casei–Case's milkvetch

Astragalus coccineus–scarlet milkvetch
Astragalus didymocarpus var. *didymocarpus*–two-seeded milkvetch
Astragalus didymocarpus var. *dispermus*–dwarf white milkvetch
Astragalus jaegerianus–Lane Mountain milkvetch
Astragalus layneae–Layne milkvetch
Astragalus lentiginosus var. *fremontii*–Fremont's milkvetch
Astragalus lentiginosus var. *micas*–shining milkvetch
Astragalus lentiginosus var. *variabilis*–freckled milkvetch
Astragalus leucolobus–Big Bear Valley woollypod
Astragalus mohavensis–curved-pod milk-vetch
Astragalus newberryi–Newberry's milkvetch
Astragalus oophorus var. *oophorus*–egg milkvetch
Astragalus purshii var. *tinctus*–Pursh's milkvetch
Dalea mollissima–downy dalea
Lupinus arboreus–yellow bush lupine
Lupinus argenteus–silvery lupine
Lupinus bicolor–miniature lupine
Lupinus brevicaulis–sand lupine
Lupinus concinnus–bajada lupine
Lupinus excubitus var. *excubitus*–grape soda lupine
Lupinus flavoculatus–yellow-eyed lupine
Lupinus magnificus var. *glarecola*–Coso Mountains lupine
Lupinus microcarpus var. *horizontalis*–chick lupine
Lupinus microcarpus var. *microcarpus*–chick lupine
Lupinus nanus–sky lupine
Lupinus odoratus–Mohave lupine
Lupinus shockleyi–desert lupine
Melilotus albus–white sweetclover
Melilotus indicus– sourclover
Prosopis glandulosa var. *torreyana*–honey mesquite
Prosopis pubescens–screw bean, tornillo
Psorothamnus arborescens–Mohave indigo-bush
Psorothamnus arborescens var. *arborescens*–Mohave indigo-bush
Psorothamnus arborescens var. *minutifolius*–Mohave indigo-bush
Psorothamnus fremontii var. *fremontii*–Fremont's indigo-bush
Psorothamnus polydenius–Nevada indigo-bush
Robinia pseudoacacia–black locust
Senna armata–spiny senna
Trifolium dedeckerae–Dedecker's clover
Trifolium gracilentum–pinpoint clover
Trifolium kingii subsp. *dedeckerae*–Dedecker's clover

Family Geraniaceae
Erodium cicutarium–redstem filareeI
Erodium texanum–Texas filaree

Family Grossulariaceae
Ribes cereum–wax currant
Ribes velutinum–desert gooseberry

Family Hydrophyllaceae
Emmenanthe penduliflora var. *penduliflora*–whispering bells
Eucrypta chrysanthemifolia var. *bipinnatifida*–spotted eucrypta
Eucrypta micrantha–small-flowered eucrypta
Nama aretioides var. *multiflorum*–sagebrush nama
Nama demissum var. *demissum*–purple mat
Nama hispidum var. *spathulatum*–hispid nama
Nemophila menziesii subsp. *integrifolia*–baby blue eyes
Phacelia bicolor var. *bicolor*–sticky yellow throats
Phacelia cicutaria var. *cicutaria*–caterpillar phacelia
Phacelia crenulata var. *crenulata*–purple phacelia
Phacelia cryptantha–limestone phacelia
Phacelia curvipes–dwarf phacelia
Phacelia distans–blue phacelia
Phacelia fremontii–yellow-throats
Phacelia humilis–low phacelia
Phacelia ivesiana–Ive's phacelia
Phacelia monoensis–Mono County phacelia
Phacelia mustelina–Death Valley round-leafed phacelia
Phacelia nashiana–desert woolstar
Phacelia pedicellata–specter phacelia
Phacelia pediculoides–sand phacelia
Phacelia perityloides–Panamint phacelia
Phacelia perityloides var. *perityloides*–Panamint phacelia
Phacelia ramosissima var. *latifolia*–dull phacelia
Phacelia rotundifolia–round-leaved phacelia
Phacelia tanacetifolia–lacy phacelia
Phacelia vallis-mortae–Death Valley phacelia
Pholistoma membranaceum–white fiesta-flower
Tricardia watsonii–three hearts

Family Krameriaceae
Krameria erecta–purple heather

Family Lamiaceae
Marrubium vulgare–horehound

Monardella exilis–annual monardella
Monardella linoides subsp. *linoides*–
flax-leaved monardella
Monardella odoratissima subsp. *odoratissima*–
mountain monardella
Pholisma arenarium–sand plant
Salazaria mexicana–bladder-sage
Salvia carduacea–thistle sage
Salvia columbariae–chia
Salvia dorrii var. *dorrii*–Great Basin blue sage
Salvia paehyphylla–thick leaf sage
Stachys albens–whitestem hedgenettle

Family Lennoaceae
Pholisma arenarium–sand plant

Family Loasaceae
Eucnide urens–rock nettle
Mentzelia affinis–yellow comet
Mentzelia albicaulis–little blazing star
Mentzelia congesta–flower baskets
Mentzelia eremophila–solitary blazing-star
Mentzelia involucrata subsp. *involucrata*–
sand blazing star
Mentzelia inyoensis–Inyo blazing star
Mentzelia nitens–Venus blazing star
Mentzelia obscura–blazing star
Mentzelia oreophila–mountain loving blazing star
Mentzelia tridentata–creamy blazing star
Mentzelia veatchiana–copper blazing star
Petalonyx nitidus–shiny sandpaper bush
Petalonyx thurberi subsp. *thurberi*–
Thurber sandpaper

Family Lythraceae
Lythrum californicum–loosestrife

Family Malvaceae
Eremalche exilis–white mallow
Eremalche rotundifolia–globe mallow
Malacothamnus fremontii–bush mallow
Malva neglecta–round-leaved mallow
Sphaeralcea ambigua var. *ambigua*–apricot mallow

Family Nyctaginaceae
Abronia pogonantha–Mojave sand-verbena
Abronia villosa var. *villosa*–desert sand verbena
Mirabilis bigelovii var. *retrorsa*–wishbone bush
Mirabilis multiflora var. *glandulosa*–
giant four-o-clock

Family Oleaceae
Forestiera pubescens–desert olive
Fraxinus anomala–single-leaf ash
Fraxinus velutina–velvet ash
Menodora spinescens–spiny mendora

Family Onagraceae
Camissonia boothii–Booth primrose
Camissonia boothii subsp. *boothii*–
Booth's desert evening primrose
Camissonia boothii subsp. *desertorum*–
Booth primrose
Camissonia boothii subsp. *inyoensis*–Inyo primrose
Camissonia brevipes subsp. *brevipes*–yellow cups
Camissonia campestris subsp. *campestris*–
Inyo suncup
Camissonia cardiophylla subsp. *robusta*–
heart-leaved primrose
Camissonia chamaenerioides–
modest evening primrose
Camissonia claviformis subsp. *claviformis*–
brown-eyed primrose
Camissonia ignota–small primrose
Camissonia kernensis subsp. *gilmanii*–
Gilman primrose
Camissonia palmeri–Palmer primrose
Camissonia pterosperma–wing-seeded primrose
Camissonia pubens–hairy primrose
Camissonia pusilla–slender hairy primrose
Camissonia refracta–narrowleaf suncup
Camissonia walkeri subsp. *tortilis*–rock primrose
Oenothera caespitosa subsp. *crinita*–
caespotose evening primrose
Oenothera califomica subsp. *avita*–
California primrose
Oenothera deltoides–devil's lantern
Oenothera primiveris–large yellow evening
primrose

Family Orobanchaceae
Orobanche cooperi subsp. *cooperi*–broomrape
Orobanche fasciculata–clustered broomrape

Family Oxalidaceae
Oxalis corniculata–creeping woodsorrel

Family Papaveraceae
Argemone corymbosa–prickly poppy
Argemone munita–desert prickly poppy
Canbya candida–pygmy poppy
Dicentra chrysantha–golden ear-drops
Eschscholzia covillei–Coville gold-poppy
Eschscholzia glyptosperma–desert gold-poppy
Eschscholzia minutifiora subsp. *covillei*–
Coville gold poppy

Eschscholzia minutiflora subsp. *minutiflora*–little gold poppy
Platystemon californicus–cream-cups

Family Philadelphaceae
Fendlerella utahensis–yerba desierto
Philadelphus microphyllus–littleleaf mock orange

Family Plantaginaceae
Plantago major–common plantain
Plantago ovata–woolly plantain
Plantago patagonica–Pursh plantain

Family Polemoniaceae
Eriastrum densifolium subsp. *mohavense*–Mojave eriastrum
Eriastrum diffusum–miniature woollystar
Eriastrum eremicum subsp. *eremicum*–desert woolly star
Eriastrum sparsiflorum–Great Basin woolly star
Eriastrum wilcoxii–Wilcox's woolly star
Gilia aliquanta subsp. *aliquanta*–puffed calyx gilia
Gilia brecciarum subsp. *argusana*–Nevada gilia
Gilia brecciarum subsp. *brecciarum*–Nevada small gilia
Gilia brecciarum subsp. *neglecta*–Kern-Inyo gilia
Gilia cana subsp. *cana*–showy gilia
Gilia cana subsp. *triceps*–showy gilia
Gilia filiformis–thread-stemmed gilia
Gilia hutchinsifolia–pale gilia
Gilia latiflora subsp. *cosana*–Coso broad-flowered gilia
Gilia latiflora subsp. *elongata*–broad-flowered gilia
Gilia latiflora subsp. *latiflora*–broad-flowered gilia
Gilia leptomeria–sand gilia
Gilia malior–scrub gilia
Gilia micromeria–dainty gilia
Gilia minor–minor gilia
Gilia modocensis–Modoc gilia
Gilia ochroleuca subsp. *ochroleuca*–pale yellow gilia
Gilia ophthalmoides–pinyon gilia
Gilia scopulorum–rock gilia
Gilia sinuata–bare-base gilia
Gilia stellata–dotted throat gilia
Gilia transmontana–star gilia
Gilia triodon–toothed gilia
Ipomopsis polycladon–spreading gilia
Langloisia setosisima subsp. *punctata*–Great Basin langloisia
Leptodactylon pungens subsp. *hallii*–prickly gilia
Linanthus arenicola–sand linanthus
Linanthus aureus var. *aureus*–golden linanthus
Linanthus bigelovii–Bigelow linanthus
Linanthus ciliatus–whisker-brush linanthus
Linanthus dichotomus–evening snow
Linanthus parryae–sand blossoms
Loeseliastrum matthewsii–desert calico
Loeseliastrum schottii–Schott's calico
Microsteris gracilis subsp. *humilis*–annual phlox
Phlox gracilis–slender phlox
Phlox stansburyi–cold desert phlox

Family Polygonaceae
Centrostegia thurberi–Thurber's spineflower
Chorizanthe brevicornu var. *brevicornu*–brittle chorizanthe
Chorizanthe rigida–rosy-thorn
Chorizanthe watsonii–Watson chorizanthe
Chorizanthe xanti var. *xanti*–Xantus chorizanthe
Eriogonum angulosum–angle-stemmed buckwheat
Eriogonum baileyi var. *baileyi*–Bailey buckwheat
Eriogonum brachyanthum–yellow buckwheat
Eriogonum brachypodum–Tecopa skeleton-weed
Eriogonum davidsonii–Heerman buckwheat
Eriogonum deflexum var. *baratum*–tall skeleton-weed
Eriogonum deflexum var. *deflexum*–skeleton-weed
Eriogonum fasciculatum var. *fasciculatum*–California buckwheat
Eriogonum fasciculatum var. *polifolium*–California buckwheat
Eriogonum glandulosum–pink mist
Eriogonum gracillimum–slender buckwheat
Eriogonum heermannii var. *argense*–Heerman buckwheat
Eriogonum heermannii var. *floccosum*–woolly Heerman buckwheat
Eriogonum heermannii var. *humilius*–Heerman buckwheat
Eriogonum inflatum var. *inflatum*–desert trumpet
Eriogonum kennedyi var. *purpusii*–ming tree buckwheat
Eriogonum maculatum–spotted buckwheat
Eriogonum mensicola–pinyon mesa wild buckwheat
Eriogonum microthecum var. *laxiflorum*–buckwheat
Eriogonum mohavense–Mojave buckwheat
Eriogonum nidularium–bird's-nest buckwheat
Eriogonum nudum var. *nudum*–nude buckwheat
Eriogonum nudum subsp. *saxicola*–robust buckwheat

Eriogonum nudum var. *westonii*–
Weston's buckwheat
Eriogonum ovalifolium–cushion buckwheat
Eriogonum palmerianum–buckwheat
Eriogonum panamintense subsp. *mensieola*–
Panamint Mt. buckwheat
Eriogonum panamintense subsp. *panamintense*–
Panamint Mt. buckwheat
Eriogonum plumatella–yucca buckwheat
Eriogonum pusillum–yellow turbans
Eriogonum reniforme–kidney leaved buckwheat
Eriogonum rixfordii–pagoda buckwheat
Eriogonum saxatile–rock buckwheat
Eriogonum spergulinum var. *reddingianum*–
buckwheat
Eriogonum thomasii–Thomas' buckwheat
Eriogonum trichopes var. *hooveri*–little trumpet
Eriogonum umbellatum subsp. *ferrissii*–
Ferris buckwheat
Eriogonum umbellatum var. *nevadense*–
Nevada buckwheat
Eriogonum wrightii var. *subscaposum*–
Wright's buckwheat
Oxytheca dendroidea–narrowleaf oxytheca
Oxytheca perfoliata–roundleaf oxytheca
Oxytheca watsonii–Watson's oxytheca
Polygonum arenastrum–common knotweed
Pterostegia drymarioides–pterostegia
Rumex crispus–curly dock
Rumex salicifolius var. *denticulatus*–willow dock

Family Portulacaceae
Calandrinia ciliata–red maids
Calyptridium monandrum–sand-cress
Calyptridium parryi var. *nevadense*–pussy paws
Claytonia perfoliata var. *utahensis*–
Utah miner's lettuce
Claytonia rubra–miner's lettuce

Family Ranunculaceae
Aquilegia formosa–crimson columbine
Aquilegia shockleyi–desert columbine
Clematis ligusticifolia–Virgin's bower
Delphinium parishii subsp. *parishii*–desert larkspur
Delphinium parryi subsp. *purpureum*–Kern
larkspur
Ranunculus cymbalaria var. *saximontanus*–
desert buttercup

Family Resedaceae
Oligomeris linifolia–leaved cambess

Family Rhamnaceae
Ceanothus greggii var. *vestitus*–desert ceanothus

Family Rosaceae
Amelanchier utahensis–service-berry
Cercocarpus intricatus–
little-leaved mountain-mahogany
Cercocarpus ledifolius–
curl-leaf mountain-mahogany
Chamaebatiaria millefolium–desert sweet
Coleogyne ramosissima–blackbrush
Holodiscus microphyllus–cream bush
Horkeliella congdonis–Congdon's false horkelia
Horkeliella purpurascens–purple false horkelia
Petrophyton caespitosum–mat rockspirea
Prunus andersonii–desert peach
Prunus fasciculata var. *fasiculata*–desert almond
Purshia mexicana var. *stansburyana*–
Mexican cliffrose
Purshia tridentata var. *glandulosa*–bitterbrush
Rosa woodsii var. *ultramontana*–wild rose

Family Rubiaceae
Galium aparine–catchweed bedstraw
Galium argense–argus bedstraw
Galium hilendiae subsp. *hilendiae*–bristly bedstraw
Galium matthewsii–bushy bedstraw
Galium stellaturn var. *eremicum*–desert bedstraw

Family Rutaceae
Thamnosma montana–turpentine broom

Family Salicaceae
Populus fremontii subsp. *fremontii*–Fremont poplar
Salix exigua–narrow-leaved willow
Salix laevigata–red willow
Salix lasiolepis–arroyo willow
Salix lucida subsp. *lasiandra*–shining willow

Family Sapindaceae
Acer glabrum var. *diffusum*–mountain maple

Family Sarcobataceae
Sarcobatus vermiculatus–greasewood

Family Saxifragaceae
Fendlerella utahensis–Utah fendlerella
Heuchera rubescens var. *alpicola*–alurnroot

Family Scrophulariceae
Antirrhinum coulterianum–Coulter snapdragon
Antirrhinum filipes–twining snapdragon
Antirrhinum kingii–least snapdragon
Buddleja utahensis–Panamint butterfly bush
Castilleja angustifolia–desert indian paintbrush

Castilleja exserta subsp. *exserta*–purple owl's clover
Castilleja linariifolia–long-leaved paintbrush
Collinsia callosa–granite collinsia
Cordylanthus eremicus subsp. *eremicus*–Panamint bird's beak
Cordylanthus kingii subsp. *helleri*–Heller's bird's beak
Cordylanthus ramosus–bushy bird's beak
Keckiella breviflora var. *breviflora*–gaping bush penstemon
Keckiella rothrockii var. *rothrockii*–Rothrock's bush penstemon
Mimulus bigelovii–Bigelow mimulus
Mimulus bigelovii var. *cuspidatus*–desert mimulus
Mimulus cardinalis–scarlet mimulus
Mimulus guttatus–common monkey-flower
Mimulus mohavensis–Mojave monkey-flower
Mimulus pilosus–clammy mimulus
Mimulus rubellus–moist sand mimulus
Mimulus rupicola–rock-midget
Mohavea breviflora–small mohavea
Mohavea confertiflora–Mojave ghost flower
Penstemon fruticiformis var. *fruticiformis*–desert mountain penstemon
Penstemon incertus–western desert penstemon
Penstemon monoensis–Mono penstemon
Penstemon palmeri var. *palmeri*–Palmer penstemon
Penstemon patens–Lone Pine beardtongue
Penstemon rostriflorus–bridge penstemon
Penstemon speciosus–showy penstemon
Scrophularia desertorum–figwort

Family Solanaceae
Datura wrightii–jimsonweed
Lycium andersonii–desert tomato
Lycium cooperi–peach thorn
Lycium pallidum var. *oligospermum*–rabbit thorn
Nicotiana attenuata–coyote tobacco
Nicotiana obtusifolia–desert tobacco
Physalis crassifolia–yellow nightshade groundcherry
Solanum americanum–nightshade

Family Tamaricaceae
Tamarix aphylla–athel
Tamarix parviflora–French tamarisk
Tamarix ramosissima–salt cedar

Family Urticaceae
Parietaria hespera var. *hespera*–rillita pellitory
Urtica dioica subsp. *holosericea*–hoary nettle

Family Verbenaceae
Verbena bracteata–verbena

Family Violaceae
Viola purpurea subsp. *purpurea*–violet

Family Viscaeae
Arceuthobium divaricatum–pinyon dwarf mistletoe

Family Vitaceae
Vitis girdiana–desert wild grape

Family Zygophyllaceae
Fagonia laevis–fagonia
Larrea tridentata–creosote bush
Larrea tridentata var. *tridentata*–creosote bush
Pegallum harmala–North African rue
Tribulus terrestris–puncture weed

ANGIOSPERMS-MONOCOTS (RUSHES, ONIONS & GRASSES)

Family Cyperaceae
Carex alma–sedge
Carex praegracilis– field sedge
Carex subfusca–brown sedge
Eleocharis parishii–parish spike-rush
Scirpus acutus–common tule
Scirpus maritimus–alkali bulrush
Scirpus robustus–alkali bulrush

Family Juncaceae
Juncus balticus–wire grass
Juncus bufonius var. *bufonius*–toad rush
Juncus mexicanus–Mexican rush
Juncus rugulosus–wrinkled rush
Juncus xiphioides–iris-leaved rush

Family Liliaceae
Allium atrorubens–dark red onion
Allium atrorubens var. *atrorubens*–dark red onion
Allium atrorubens var. *cristatum*–wild onion
Allium fimbriatum–fringed onion
Allium lacunosum subsp. *tiavisiae*–pitted onion
Calochonus kennedyi var. *kennedyi*–Mariposa lily
Calochortus panamintensis–Panamint mariposa lily
Dichelostemma capitatum–blue dicks
Dichelostemma capitatum subsp. *pauciflorum*–blue dicks
Muilla coronata–little muilla

Muilla maritima–common muilla
Yucca brevifolia–Joshua tree
Smilacina stellata–panicled false Solomon's-seal
Zigadenus brevibracteatus–desert zygadenus

Family Orchidaceae
Epipactis gigantea–stream orchid

Family Poaceae
Achnatherum hymenoides–Indian ricegrass
Achnatherum occidentalis subsp. *occidentalis*–needlegrass
Achnatherum parishii–needlegrass
Achnatherum speciosum–desert needlegrass
Agrostis stolonifera–creeping bent (I)
Aristida glauca–reverchon three-awn
Aristida purpurea var. *fendleriana*–*Fendler three*-awn
Aristida purpurea var. *nealleyi*–reverchon three-awn
Blepharidachne kingii–king's eyelash grass
Bouteloua barbata var. *barbata*–six weeks gramma grass
Bromus arizonicus–Arizona brome
Bromus carinatus var. *carinatus*–California brome
Bromus catharticus–rescue grass
Bromus ciliatus–fringed brome
Bromus diandrus–ripgut
Bromus madritensis subsp. *rubens*–foxtail chess (I)
Bromus tectorum–downy brome
Bromus trinii–Chilean brome
Cynodon dactylon–Bermuda grass (I)
Distichlis spicata–saltgrass
Elymus elymoides subsp. *elymoides*–squirreltail
Elymus multisetus–big squirreltail
Erioneuron pulchellum–fluffgrass
Festuca microstachys–eastwood fescue
Hordeum murinum subsp. *leporinum*–mouse barley
Leymus cinereus–Great Basin wild rye
Leymus condensatus–giant wild rye
Leymus triticoides–beardless wild rye
Melica frutescens–tall melica
Melica imperfecta–small-flowered melica
Melica stricta–rock melicagrass
Muhlenbergia asperifolia–scratchgrass
Muhlenbergia porteri–bush muhly
Muhlenbergia rigens–deergrass
Paspalum distichum–ditch grass
Phragmites australis–common reed (I)
Pleuraphis jamesii–galleta
Pleuraphis rigida–big galleta
Poa fendleriana subsp. *longiligula*–longtongue mutton grass
Poa secunda subsp. *secunda*–one-sided blue grass
Poa secunda subsp. *juncifolia*–rush blue grass
Polypogon monspeliensis–rabbitfoot-grass
Schismus arabicus–Arabian schismus
Schismus barbatus–Mediterranean schismus
Spartina gracilis–alkali cordgrass
Sporobolus airoides–alkali sacaton
Vulpia microstachys var. *ciliata*–eastwood fescue
Vulpia microstachys var. *pauciflora*–Pacific fescue
Vulpia octoflora var. *octoflora*–sixweeks fescue

Family Potamogetonaceae
Potamogeton pusillus–small pondweed

Family Typhaceae
Typha domingensis–southern cattail

I.2 Invertebrates Known to Occur at NAWS China Lake

Note: Number next to "sp." indicates number of unidentified species found on base.

ORDER ARANEAE (SPIDERS)

Family Agelenidae
Hololena nevada

Family Araneidae
Araneidae sp.

Family Dictynidae
Dictyna sp.
Dictynidae sp.
Emblyna reticulata
Kukulcania sp.
Mallos pallidus
Saltonia incerta (?)

Family Gnaphosidae
Gnaphosa sp.
Drassyllus insularis
Callilepis gosoga
Herpyllus hesperolus
Gnaphoa californica
Zelotes griswoldi

Family Iuridae
Hadrurus arizonensis
Hadrurus obscurus
Hadrurus spadix

Family Linyphiidae
Erigone sp.

Family Liocranidae
Phrurotimpus sp.

Family Lycosidae
Allocosa subparva
Alopecosa kochii
Pardosa altamontis

Family Oxyopidae
Oxyopes sp.

Family Philodromidae
Apollophanes texanus
Ebo californicus
Tibellus chamberlini

Family Pholcidae
Physocyclus sp. nr. tanneri
Psilochorus sp.

Family Plectreuridae
Plectreuridae sp.

Family Theridiidae
Euryopis sp.
Steatoda washona
Steatoda fulva
Steatoda pulcher
Steatoda sp.

Family Thomisidae
Misumenops deserti
Misumenops importunus belkini
Misumenops rothi

Family Salticidae
Habronathus sp.
Salticidae sp.

Family Superstitionidae
Superstitionia donensis

Family Uloboridae
Uloborus sp.

Family Vaejovidae
Paruroctonus becki
Paruroctonus silvestrii
Paruroctonus boreus
Paruroctonus sp.
Serradigitus wupatkiensis
Vaejovis confusus

Unknown Family
Anuroctonus phaiodactyla

ORDER ARCHAEOGNATHA (BRISTLETAILS)

Family Machilidae
Mesomachilis californica

ORDER ISOPTERA (TERMITES)

Family Termitidae
Termitidae sp.

ORDER ODONATA (DAMSELFLIES & DRAGONFLIES)

Family Aeshnidae
Aeshna multicolor
Anax junius
Anax walsingham

Family Calopterygidae
Hetaerina americana

Family Coenagrionidae
Argia alberta
Argia nahuana
Argia vivida
Coenagrionidae spp.
Enallagma carunculatum
Enallagma civile
Enallagma cyathigerum
Ischnura barberi
Ischnura cervula
Ischnura denticollis
Ischnura parparva
Telebasis salva

Family Cordulegasteridae
Cordulegaster dorsalis

Family Libellulidae
Brechmorhoga mendax
Erythemis collocata
Libellula comanche
Libellula composita
Libellula forensis
Libellula saturata
Pachydiplax longipennis
Pantala hymenaea
Sympetrum corruptum
Sympetrum illotum
Sympetrum occidentale
Tramera lacerata
Tramea onusta

ORDER ORTHOPTERA (CRICKETS & GRASSHOPPERS)

Family Acrididae
Aeolophides tenuipennis
Bootettix argentatus
Cibolacris parviceps
Cordillacris occipitalis
Derotmema laticinctum
Derotmema sp.
Eremiacris pallida
Hesperotettix viridis
Melanoplus cinereus
Melanoplus spp. (2 unidentified species)
Poecilotettix sanguineus
Trimerotropis cyaneipennis
Trimerotropis pallidipennis
Trimerotropis pseudofasciata

Family Eumastacidae
Morsea californica

Family Gryllacrididae
Ceuthophilus sp.
Stenopelmatus sp.

Family Gryllidae
Acheta assimilis
Acheta domestica
Nemobiinae sp.
Oecanthus californicus
Oecanthus sp.

Family Tanaoceridae
Tanaocerus koebelli

Family Tettigonidae
Arethaea gracilipes
Capnobotes fuliginosus
Decticinae sp.
Microcentrum sp.
Neduba ovata
Paratettix sp.

ORDER EMBIIDINA (WEBSPINNERS)

Family Oligotomidae
Oligotoma nigra

ORDER MANTODEA (MANTIDS)

Family Mantidae
Litaneutria minor
Stagmomantis californica

ORDER BLATTODEA (COCKROACHES)

Family Polyphagidae
Arenivaga apache
Arenivaga sp.
Eremoblatta subdiaphana

ORDER HEMIPTERA (TRUE BUGS)

Family Alydidae
Protenor belfragei
Tollius setosus

Family Anthocoridae
Orius tristicolor

Family Berytidae
Jalysus wickhami

Family Coccidae
Ceroplastes irregularis

Family Coreidae
Anasa sp.
Leptogglossus clypealis
Mecocoris curtatus

Family Corixidae
Corisella decolor

Family Cydnidae
Cydnidae sp.

Family Dictyopharidae
Orgerius concolor

Family Gerridae
Gerris remigis

Family Largidae
Largus californicus
Largus cinctus

Family Lygaeidae
Geocoris pallens
Oncopeltus fasciatus
Neacoryphus bicrucis
Neacoryphus lateralis
Neacoryphus sp.
Nysius tennellus
Lygaeidae spp. (9 unidentified species)
Lygaeus kalmii
Lygaeus sp.
Pseudopamera nitidula
Rhyparochromus saturnius

Family Mesoviliidae
Mesoviliidae sp.

Family Miridae
Chlamydatus monilipes
Coquilletia sp.
Deracocoris brevis
Hadronema princeps
Irbesia sp.
Miridae spp. (21 unidentified species)
Parthenicus picicollis
Phytocoris ramosus
Phytocoris spp. (14 unidentified species)
Phytocoris vanduzei
Rhinocloa forticornis
Taylorilgus pallidulus

Family Nabidae
Nabis americoferus

Family Notonectidae
Notonectidae sp.

Family Pentatomidae
Chlorochra sayi
Dendrociris contaminatus
Pentatomidae spp. (3 unidentified species)
Perillus splendidus
Thyanta custator
Thyanta pallidovirens

Family Phymatidae
Phymata americana
Phymata pacifica

Family Reduvidae
Emesinae spp. (2 unidentified species)
Sinea complexa
Triatoma sp.
Zelus renardii
Zelus tetracanthus

Family Rhopalidae
Arhyssus lateralis
Arhyssus scutatus
Aufeius impressicollis
Harmostes reflexus
Liorhyssus hyalinus
Rhopalidae sp.

Family Saldidae
Saldidae sp.
Saldula pallipea

Family Scutelleridae
Scutelleridae spp. (2 unidentified species)

Family Threocoridae
Threocoridae sp.

Family Tingidae
Tingidae spp. (5 unidentified species)

Family Veliidae
Microvelia pulchella

ORDER HOMOPTERA (APHIDS, HOPPERS & CICADAS)

Family Acanaloniidae
Acanaloniidae spp. (3 unidentified species)

Family Achilidae
Achilidae spp. (2 unidentified species)

Family Aphidae
Aphidae spp. (2 unidentified species)

Family Cercopidae
Cercopidae spp. (2 unidentified species)

Family Cicadellidae
Cicadellidae spp. (49 unidentified species)
Lystrides nuda
Norvellina spp.

Family Cicadidae
Okanagana bella
Okanagana magnifica
Okanagana pallidula
Platypedia putnamii

Family Cixiidae
Cixiidae spp. (5 unidentified species)

Family Dactylopiidae
Dactylopius sp.

Family Delphalcidae
Delphalcidae sp.

Family Derbidae
Derbidae sp.

Family Dictyopharidae
Corisella decolor
Deserta bipunctata
Dictyopharidae spp. (3 unidentified species)

Family Flatidae
Flatidae sp.
Ormenis saucia

Family Issidae
Issidae sp.

Family Psyllidae
Psyllidae spp. (10 unidentified species)

ORDER NEUROPTERA (NET-WINGED INSECTS)

Family Ascalaphidae
Ululodes arizonensis

Family Berothidae
Lomamyia sp.
Lomamyia tenuis

Family Chrysopidae
Chrysopa coloradensis
Chrysoperla comanche
Chrysoperla florabunda
Chrysoperla phlorabunda
Eremochrysa punctinervis
Eremochrysa sp.
Eremochrysa tiabialis
Leucochrysa nigrinervis
Meleoma schwartzi
Pseudomallada perfectus
Yumachrysa apache

Family Coniopterygidae
Aleuropteryx sp.
Coniopteryx sp.

Family Hemerobiidae
Hemerobius spp. (2 unidentified species)
Megalomus moestus
Micromus variolosus
Sympherobius killingtoni
Tyttholeon puerilis

Family Mantispidae
Leptomantispa pulchella
Plega signata
Plega dactylota

Family Myrmeleontidae
Brachynemurus blandus
Brachynemurus ferox
Brachynemurus sackeni
Chaetoleon pusillus
Clathroneuria coquilletti
Clathroneuria schwarzi
Dendroleon speciosus
Eremeoleon insipidus
Eremeoleon nigribasis
Gnopholeon barberi
Mexoleon papago
Myrmeleon californicus
Myrmeleon exitalialis
Paranthaclisis congener
Psammoleon connexus
Psammoleon normalis
Psammoleon sinuatus
Scotoleon carrizonus
Scotoleon eiseni
Scotoleon fidelitas
Scotoleon longipalpis
Scotoleon niger
Scotoleon yavapai

Family Raphidiidae
Agulla bicolor
Agulla sp.

ORDER COLEOPTERA (BEETLES)

Family Alleculidae
Alleculidae spp. (2 unidentified species)
Hymenorus montivagos

Family Anobiidae
Anobiidae spp. (8 unidentified species)
Xeranobium sp.

Family Anthicidae
Anthicidae spp. (3 unidentified species)

Family Bostrichidae
Bostrichidae spp. (2 unidentified species)

Family Bruchidae
Bruchidae sp.

Family Buprestidae
Acmaeodera latiflava
Acmaeodera purshiae
Acmaeodera sp.
Acmaeodera tuta
Agrilus blandus
Agrilus inhabilis
Agrilus niviententris
Agrilus walsinghami
Anthaxia spp. (2 unidentified species)
Buprestidae sp.
Chrysobothris cyanella
Hippomelas dianae
Hippomelas obliteratus
Nanularia bruneata
Phaenops californica

Family Cantharidae
Cantharidae spp. (3 unidentified species)

Family Carabidae
Amblychila sp.
Agonum funebre
Bembidion variegatum
Carabidae spp. (15 unidentified species)
Cicindela sp.

Family Cerambycidae
Aneflomorpha spp. (3 unidentified species)
Cerambycidae spp. (4 unidentified species)
Judolia sp.
Megacheuma brevipennis
Moneilema sp.
Prionus californicus
Prionus sp.

Family Chrysomelidae
Acalymma trivittata.
Altica carinata
Chrysomelidae spp. (24 unidentified species)
Diabrotica undecimpunctata
Exema sp.
Galerucella xanthomelaena
Pachybrachys desertus
Saxinus saucia

Family Cleridae
Cleridae spp. (3 unidentified species)
Cymatodera oblita
Cymatodera punctata
Enoclerus laetus
Trichodes ornatus

Family Coccinellidae
Brumoides septentrionis
Brumus aethiops
Coccinellidae spp.
Hippodamia apicalis
Hippodamia convergens
Olla v-nigrum
Psyllobora renifer

Family Curculionidae
Curculionidae spp. (9 unidentified species)

Family Dascillidae
Dascillidae sp.

Family Dermestidae
Dermestidae spp. (4 unidentified species)

Family Dytiscidae
Dytiscidae spp. (5 unidentified species)

Family Elateridae
Aeolus sp.
Elateridae spp. (6 unidentified species)
Octinodes frater
Octinodes shaumi

Family Gyrinidae
Gyrinidae sp.

Family Haliplidae
Haliplidae sp.

Family Histeridae
Histeridae spp. (2 unidentified species)

Family Hydrophilidae
Enochrus sp.
Hydrophilidae spp. (7 unidentified species)
Hydrophilus triantularis
Troposternus lateralis

Family Meloidae
Cordylospasta opaca
Cysteodemus arnatus
Epicauta lauta
Eupompha elegans
Gnathium sp.
Lytta auriculata
Lytta magister
Lytta stygica
Lytta vulnerata
Meloidae sp.
Nemognatha nigripennis
Nemognatha sp.
Tegrodera latecincta
Zonitis atripennis

Family Melyridae
Attalus spp. (6 unidentified species)
Callops sp.
Malachius sp.
Melyridae spp. (8 unidentified species)
Tanaops spp. (6 unidentified species)

Family Mordellidae
Mordella albosutura
Mordellidae spp. (5 unidentified species)

Family Nitidulidae
Nitidulidae spp. (5 unidentified species)

Family Oedemeridae
Oedemeridae sp.
Rhinoplatia ruficollis

Family Phalacridae
Phalacridae sp.

Family Phengodidae
Phengodidae sp.
Zarhipis integripennis

Family Pselaphidae
Pselaphidae sp.

Family Ptinidae
Ptinidae sp.

Family Rhipiphoridae
Rhipiphoridae sp.

Family Salpingidae
Salpingidae sp.

Family Scarabaeidae
Aphodius sp.
Cremastocheilus armatos
Cyclocephala longula
Diplotaxis moerens
Diplotaxis subangulata
Polyphylla decemlinea
Polyphylla spp.
Scarabaeidae spp. (3 unidentified species)
Serica mckenziei
Serica spp. (2 unidentified species)

Family Silphidae
Nicrophorus sp.

Family Staphylinidae
Staphylinidae spp. (12 unidentified species)

Family Tenebrionidae
Alleculinae sp.
Aloephus sp.
Blapstinus sp.
Cerenopus sp.
Coniontis ellyptica
Coniontis sp.
Cryptoglossa laevis
Cryptoglossa muricata
Eleodes gracilis
Eleodes spp. (3 unidentified species)
Eupsophulus castaneus
Hymenorus montivagos
Metopoloba sp.
Philolithus actuosus
Tenebrionidae spp. (4 unidentified species)
Trogloderus costatus

Family Trogositidae
Trogositidae sp.

ORDER TRICHOPTERA (CADDISFLIES)

Family Hydropsychiidae
Hydropsychiidae sp. (I)

Family Leptoceridae
Leptoceridae spp. (2 unidentified species)

Family Limnephilidae
Limnephilidae sp.

Family Rhyacophilidae
Rhyacophilidae sp.

ORDER LEPIDOPTERA (MOTHS & BUTTERFLIES)

Family Acrolophidae
Acrolophus sp.
Acrolophus vauriei

Family Arctiidae
Arachnis picta
Arachnis verna

Family Coleophoridae
Holcocera sp.

Family Cossidae
Comadia henrici
Givera cornelia
Givera ethela
Givera mucida
Hypocala andremona
Hypopta palmata

Family Crambidae
Mecyna sp.

Family Erebidae
Catocala aholibah
Catocala faustina
Catocala junctura
Melipotis indomita
Synedoida scrupuldsa

Family Gelichiidae
Aristotelia sp.
Aroga eldorada
Lita sp.

Family Geometridae
Animomyia smithi
Anticlea pectinata
Archirhoe neomexicana
Cheteoscelis bistriaria
Chloroclamys appellaria
Chlorosea margaretaria
Cochisea recisa
Dysstroma formosa
Eupithecia deserticola
Glaucina baea
Glaucina cilla
Glaucina erroraria
Glaucina golgolata
Glaucina gonia
Glaucina magnificata
Glaucina ochrofusa
Glena nigricaria
Hesperia juba
Hulstina imitata
Hulstinia imitatria fulva
Hulstina mitetrix
Hulstina xera
Icaricia lupini
Itame colata
Lobocleta lanceolata
Malacosoma californica
Marmopteryx animata
Marmopteryx tessellata
Nacophora utahensis
Narraga fimetaria
Nasusina minuta
Nemoria intensaria
Nemoria obligua
Nepytia juabata
Parabagrotis insularis
Paraglaucina hulstinoides
Peridroma saucia
Perizoma custodiata
Pero behrensarius
Pero meskarius
Pero modestus
Petrova arizonensis
Pherne sperryi
Pholisora libya
Plataea californiara
Plataea diva
Plataea trilinearia
Prochloridea modesta
Prochoerodes truxaliata
Pterotaea sperryi
Rhynchagrotis exsertistigma
Sabulodes dissimilis
Scotogramma yakima
Semiothisa californica
Semiothisa colorata
Semiothisa cyda
Semiothisa denticulata
Semiothisa errata
Semiothisa excurvata
Semiothisa neptaria
Semiothisa pictipennata

Stylopoda groteana
Sumatolophia montana
Synedoidea fumosa
Synglochis perumbrara
Xanthorhoe spaldingaria
Zenophleps obscurata

Family Hesperidae
Atalopedes campestris
Copaeodes aurantiaca
Erynnis funeralis
Helioptes ericetorum
Hemileuca burnsi
Hesperia harpalus
Hesperia juba
Hyalophora gloveri
Hylephila phleus
Megathymus yucca
Nymphalis californica
Ochlodes yuma
Pherne sperryi
Pholisora alpheus
Pholisora libya
Pyrausta pseudonythesalis
Pyrgus albescens
Pyrgus communis
Pyrgus scriptura

Family Lasciocampidae
Lycaena arota
Malacosoma californica

Family Lycaenidae
Allerastria albiciliata
Brephidium exilis
Callophrys comstocki
Celastrina ladon
Euphilotes battoides argocyanea
Euphilotes baueri vernalis
Euphilotes bernardino inyomontanus
Euphilotes enoptes nr. tildeni
Euphilotes intermedia comstocki
Euphilotes mojave
Euphilotes pallescens
Everes amyntula
Glaucopsyche lygdamus
Hemeroplanis historialis
Hemiargus ceraunus
Hemiargus isola
Hypopta palmata
Icaricia acmon
Icaricia icarioides
Icaricia lupini
Incisalia augustinus
Incisalia fotis
Leptotes marinus
Loranthomitoura spinetorum
Loxostege stictalis
Lycaena arota
Mitoura siva
Philotiella speciosa
Plebejulina emigdionis
Sabulodes dissimilis
Satyrium behrii
Satyrium saepium
Satyrium silvinus
Spodoptera yakima
Strymon melinus

Family Noctuidae
Abagrotis barnesi
Abagrotis discoidas
Abagrotis duanca
Abagrotis erratica
Abagrotis forbesi
Abagrotis nefascia
Abagrotis mirabilis
Abagrotis reedi
Abagrotis vittifrons
Acontia arida
Acontia cretata
Acontia disconecta
Acontia oretata
Acontia tetragonia
Agrotis ipsilon
Allerastria albiciliata
Alypia ridingsi
Apamea occideus
Apamea spaldingi
Aseptis adnixa
Aseptis characta
Aseptis monica
Aseptis pausis
Aseptis serrula
Asticta victoria
Autographa californica
Autographa pasiphaeia
Bulia deducta
Bulia similaris
Canochares arizonae
Catocala faustina
Catocala hermia
Catocala junctura

Chalcopasta koebelei
Conochares arizonae
Copablepharon viridisparsum
Copicucullia antipoda
Cupicucullia cucullioides
Copicucullia eulipis
Copicucullia heinrichi
Cucullia cuculliodes
Cucullia eulepis
Cynidiodea tejonicus
Dargida procincta
Discestra fulgora
Euchalcia alba vitta
Euxoa annulipes
Euxoa atomaris
Euxoa auxiliaris
Euxoa brevipennis
Euxoa catenula
Euxoa citricolor
Euxoa comosa
Euxoa misturata
Euxoa obeliscoides
Euxoa olivalis
Euxoa oncocnemordis
Euxoa plagigera
Euxoa pluralis
Euxoa recula
Euxoa septenmionalis
Euxoa serricornis
Euxoa silens
Euxoa subandera
Euxoa terrena
Euxoa tronella
Euxoa unica
Grotella stretchii
Grotellaforma lactea
Heliothodes diminutivis
Heliothis belladona
Heliothis phloxiphagus
Heliothis zea
Heliothodes diminutivis
Hemeroplanis historialis
Hyles lineata
Hypocala andremona
Jocara trabalis
Lacinapolia illaudablis
Lacinipolia stenotis
Lacinapolia vicina
Lathosea pulla
Mecyna mustelinalis
Melipotis indamita
Mesoligia invenusta
Mimoschima rufofascialis
Nepytia juabata
Nocloa pallens
Noctua pronuba
Ochlodes yuma
Oligia marina
Oligia tonsa
Oncocnemis atricollaris
Oncocnemis benjamini
Oncocnemis chorda
Oncocnemis corusca
Oncocnemis deceptiva
Oncocnemis lacticollis
Oncocnemis levis
Oncocnemis obscurata
Oncocnemis primula
Oncocnemis tricollaris
Oxycenemis fusimacula
Papilio polyxenes
Parabagrotis exsertistigma
Parabagrotis formalis
Parabagrotis insularis
Paraglaucina hulstinoides
Peridroma saucia
Platyperigea atrostriga
Podagra crassipes
Precis coenia
Prochloridea modesta
Prochoerodes truxaliata
Protogygia lagena
Protogygia querula
Protorthodes alfkeni
Protorthodes texana
Provia argentata
Pseudaletia unipuncta
Pseudanarta actura
Pseudanarta caeca
Pseudanarta crocea
Pseudohadena vulnerea
Pyrgus scriptura
Rancora comstocki
Rhizagrotis albalis
Rhynchagrotis exsertistigma
Satyrium silvinus
Schinia acutilinea
Schinia argentifascia
Schinia balba
Schinia erosa
Schinia groteana
Schinia ligeae

Schinia seperata
Schinia sueta
Schinia tertia
Schinia unimacula
Schinia velaris
Schinia walsinghami
Scotogramma lyahima
Scotogramma ptilodonta
Scotogramma stretchii
Scotogramma yakima
Sesia sp.
Setagrotis atrifrons
Setagrotis groteana
Setagrotis piscippellis
Setagrotis radiatus
Smerinthus cerisyi
Spaelotis havilae
Spodoptera exigua
Spodoptera praefica
Spodoptera yakima
Strymon melinus
Stylopoda groteana
Synanthedon polygoni
Synedoida scrupulosa
Synedoida fumosa
Thessalia leanira
Triacnemis saporis
Trichoclea postica
Trichoplusia ni
Trichopolia dentatella
Tridepia nova
Trichocerapoda oblita
Trichocerapoda strigata
Triocnemis saporis
Ufeus plicatus hulsti
Ulolonche dilecta
Uria noctuiformis
Zale insuda

Family Notodontidae
Furcula nivea

Family Nymphalidae
Cercyonis sthenele
Charidryas neumogeni
Charidryas palla
Danaus gillippus
Danaus plexippus
Nocloa pallens
Nymphalis antiopa
Nymphalis milberti
Nymphalis californica
Podagra crassipes
Polydryas arachne
Polygonia satyrus
Polygonia zephyrus
Pontia sysimbrii
Precis coenia
Synglochis perumbrara
Thessalia leanira
Uria noctuiformis
Vanessa annabella
Vanessa atlanta
Vanessa cardui
Vanessa virginiensis

Family Papilionidae
Palpita gracilalis
Papilio polyxenes coloro
Papilio rutulus

Family Pieridae
Anthocharis cethura
Anthocharis sara
Artogeia rapae
Cercyonis sthenele
Coenympha californica
Colias eurytheme
Euchloe hyantis
Eurema nicippe
Nathalis iole
Phoebis sennae
Pieris rapae
Polydryas arachne
Pontia beckeri
Pontia protodice
Pontia sisymbrii
Zerene cessonia

Family Prodoxidae
Tegeticula synthetica

Family Pterophoridae
Oidaematophorus sp.
Pseudohadena vulnerea
Pterophoridae spp. (6 unidentified species)

Family Pyralidae
Achyra occidentalis
Achyra rantalis
Alberada parabates
Anemosella nevalis
Arta sp.
Cahela ponderosella
Dioryctria fordi

Eremberga leuconips
Eumysia idahognsis
Heterographis morrisonella
Itame colata
Jocara trabalis
Loranthomitoura spinetorum
Loxostege indentialis
Loxostege kearfottalis
Loxostege stictalis
Marmopteryx tessellata
Mecyna luscitalis
Mecyna mustelinalis
Oxycenemis fusimacula
Palpita gracilalis
Pyralidae sp.
Pyrausta lethalis
Pyrausta pseudonythesalis
Sarata edwardsialis
Sosipatra rileyella

Family Rhyacophilidae
Aberratica ornatus
Acroplectius haemanlues
Epiblemia sp.
Leptarctica californicae
Leucocnemia variabilis
Lilhariapteryx mirahilinella
Middera eurilia
Passadena flairdorsella
Plagiomim tepperi
Prottexana consors
Walternella ocellata

Family Riodinidae
Apodemia mormo cythera
Apodemia mormo deserti
Calephelis wrighti

Family Saturnidae
Hemiargus ceraunus
Hemileuca burnsi
Hemileuca hera
Hemileuca neumoegeni
Hulstina xera
Hyalophora gloveri

Family Sesiidae
Carmenta mariona
Semiothisa pictipennata
Sessia sp.
Sumatolophia montana
Sumatolophia simplicia
Synanthedon polygoni

Family Sphingidae
Hylephilis phleus
Hyles lineata
Setagrotis radiatus
Smerinthus cerisyi

Family Tiniedae
Acolophus sp.
Acrolophus variabilis

Family Tortricidae
Cydia latiferreana
Eucosma caniceps
Petrova arizonensis
Phaneta hensamihe complex
Sonia vovana
Spaelottis clandestina
Spaelotis havilae
Tortricidae spp.

Family Ypsolophidae
Ypsolopha arizonella
Ypsolopha barberella
Ypsolopha delicatella

Family Zygaenidae
Harrisina brillians

ORDER DIPTERA (FLIES)

Family Agromyzidae
Agromyzidae spp. (6 unidentified species)
Cerodontha sp.
Liriomyza sp.
Phytobia sp.
Fucelia sp.

Family Anisopodidae
Anisopodidae sp.

Family Anthomyidae
Anthomyidae spp. (9 unidentified species)

Family Anthomyzidae
Anthomyzidae spp. (2 unidentified species)

Family Apioceridae
Apiocera exta
Apiocera haruspex
Rhaphiomidas acton

Family Asilidae
Ablautus californicus
Ablautus sp.
Asilidae spp. (13 unidentified species)
Asilus sp.
Asilus occidentalis
Asilus rubidus
Callinicus vittatus
Callinicus pictifax
Cerotainiops sp.
Coleomyia sp.
Cophura vanduzeei
Efferia benedicti
Efferia producta
Efferia spp.
Heteropogon rubidus
Heteropogon senilis
Heteropogon sp.
Hodophylex halli
Laphria sp.
Leptogaster sp.
Mallophorina frustra
Metapogon tricellus
Saropogon hyalinus
Stenopogon spp.

Family Bibionidae
Bibio alpipennis

Family Bombyliidae
Anthrax sp.
Aphoebantus sp.
Apolysis sp.
Bombyliidae spp.
Bombylius heximarulatus
Chrysanthrax spp.
Conophorus fenestratus
Exoprosopa sp.
Geron spp.
Hemipenthes eumenes
Heterostylum robustum
Lepidanthrax inauratus
Lepidanthrax sp.
Lordotus cingulatus
Lordotus luteolus
Lordotus sp.
Mythicomyia sp.
Oligodranes sp.
Pantarbes spp. (2 unidentified species)
Paravilla spp.
Paravilla syrtis
Phthiria sp.
Poecilanthrax californicus
Poecilanthrax sp.
Poecilanthrax willistoni
Prorates sp.
Thyridanthrax sp.
Toxophora sp.
Toxophora virgata
Triploechus sp.
Villa agrippina
Villa arenosa
Villa sp.

Family Calliphoridae
Aldrichina sp.
Calliphoridae spp. (8 unidentified species)
Cochliomyia macellaria

Family Cecidomyiidae
Cecidomyiidae spp. (9 unidentified species)
Neolasioptera willistoni

Family Ceratopogonidae
Atrichopogon sp.
Ceratopogonidae spp. (5 unidentified species)

Family Chamaemyiidae
Leucopsis sp.

Family Chironomidae
Chironomidae spp. (8 unidentified species)

Family Chloropidae
Chloropidae spp. (8 unidentified species)
Gaurax sp.
Meromyia sp.
Siphonella spp.
Thaumatomyia sp.

Family Conopidae
Conopidae spp. (4 unidentified species)
Dalmannia sp.

Family Culicidae
Culicidae sp.

Family Cuterebridae
Cuterebra sp.

Family Diastatidae
Diastatidae sp.

Family Dolichopodidae
Achradocera sp.
Diaphorus sp.
Dolichopodidae spp. (16 unidentified species)
Gymnopternus spp. (3 unidentified species)
Hercostomus sp.

Hydrophorus sp.
Paraclius sp.
Syntormon sp.
Tachytrechus sp.

Family Drosophilidae
Drosphilidae spp. (3 unidentified species)

Family Empididae
Drapetis sp.
Empididae spp. (4 unidentified species)
Platypalpus spp. (2 unidentified species)

Family Ephydridae
Dichaeta sp.
Ephydridae spp. (23 unidentified species)
Notiphila sp.
Oedenops sp.
Parydra spp. (3 unidentified species)
Polytricophora sp.
Scatella sp.
Typopsilopa sp.

Family Heleomyzidae
Heleomyzidae spp. (2 unidentified species)

Family Lauxaniidae
Lauxaniidae spp. (9 unidentified species)

Family Lonchaeidae
Lonchaeidae sp.

Family Lonchopteridae
Lonchopteridae sp.

Family Milichiidae
Milichiidae spp. (4 unidentified species)

Family Muscidae
Muscidae spp. (28 unidentified species)
Stomoxya calcitrans

Family Mycetophilidae
Mycetophilidae spp. (4 unidentified species)

Family Mydidae
Mydidae sp.

Family Otitidae
Otitidae spp. (2 unidentified species)

Family Phoridae
Phoridae spp. (3 unidentified species)

Family Piophilidae
Piophilidae spp. (2 unidentified species)

Family Pipunculidae
Pipunculidae sp.

Family Platystomatidae
Platystomatidae sp.

Family Psilidae
Psilidae sp.
Family Psychodidae
Psychodidae spp. (2 unidentified species)

Family Pyrgotidae
Pyrgota sp.

Family Rhagionidae
Rhagionidae sp.

Family Sarcophagidae
Blaesoxipha plinthopyga
Sarcophagidae sp.

Family Scatopsidae
Scatopsidae sp.

Family Scenopinidae
Scenopinidae spp. (2 unidentified species)

Family Sciaridae
Sciaridae spp. (5 unidentified species)

Family Sciomyzidae
Sciomyzidae spp. (3 unidentified species)

Family Sepsidae
Sepsidae sp.

Family Simulidae
Simulidae spp. (7 unidentified species)

Family Sphaeroceridae
Sphaeroceridae spp. (3 unidentified species)

Family Stratiomyidae
Stratiomyidae spp. (4 unidentified species)

Family Syrphidae
Allograpta exotica
Eristalis latifrons
Eupeodes volucris
Mesograpta marginata
Platycheirus stegnus
Syrphidae spp. (11 unidentified species)

Family Tabanidae
Apatolestes comastes
Apatolestes sp.
Chrysops sp.
Tabanidae sp.
Tabanus punctifer

Family Tachinidae
Cylindromyia armata

Euphasiopteryx ochracea
Gymnosoma fuliginosum
Peleteria malleola
Phasia aldrichii
Tachinidae spp. (36 unidentified species)

Family Tephritidae
Tephritidae spp. (16 unidentified species)

Family Therevidae
Thereva spp. (9 unidentified species)

Family Tipulidae
Tipulidae spp. (17 unidentified species)

Family Trixoscelidae
Trixoscelidae spp. (3 unidentified species)

ORDER HYMENOPTERA (ANTS, WASPS & BEES)

Family Andrenidae
Andrena blaisdelli
Andrena palpalis
Andrena spp. (4 unidentified species)
Andrenidae spp. (5 unidentified species)
Calliopsis sp.
Perdita spp. (4 unidentified species)

Family Anthophoridae
Anthophoridae spp. (11 unidentified species)
Apis mellifera
Bombus crotchi
Bombus vosnesenshii
Melissodes spp. (4 unidentified species)
Nomada sp.
Xeromeleata larreae
Xylocopa californica

Family Bethylidae
Bethylidae spp. (4 unidentified species)

Family Braconidae
Braconidae spp. (36 unidentified species)
Chyphotes melaniceps
Cyphotes mickeli
Cyphotes nubeculus

Family Bradynobaenidae
Chyphotes melaniceps
Cyphotes mickeli
Cyphotes nubeculus

Family Ceraphronidae
Ceraphonidae spp. (4 unidentified species)

Family Chalcididae
Chalcididae spp. (5 unidentified species)

Family Chrysididae
Chrysidae spp. (5 unidentified species)
Hedychrum boharti

Family Colletidae
Colletidae spp. (9 unidentified species)

Family Cynipidae
Cynipidae sp.

Family Diprionidae
Diprionidae sp.

Family Encyrtidae
Encyrtidae spp. (5 unidentified species)
Ooencyrtus sp.

Family Eulophidae
Eulophidae spp. (10 unidentified species)

Family Eupelmidae
Eupelmidae spp. (4 unidentified species)

Family Eurytomidae
Eurytomidae spp. (4 unidentified species)

Family Figitidae
Figitidae sp.
Melanips sp.

Family Formicidae
Brachymyrmex depilis
Camponotus semitestaceus
Camponotus spp. (4 unidentified species)
Crematogaster spp. (2 unidentified species)
Forelius sp.
Formica francoeuri
Formica spp. (4 unidentified species)
Iridomyrmex sp.
Leptothorax rugatulus
Liometopum occidentale
Monomorium minimum
Myrmococystus mexicanus
Myrmococystus sp.
Pogomyrmex rugosus
Pogomyrmex sp.
Pseudomyrmex pallidus
Pseudomyrmex apache
Solenopsis xyloni
Tapinoma sessile
Veromessor sp.

Family Halictidae
Halictidae spp. (9 unidentified species)

Family Ichneumonidae
Ichneumonidae spp. (49 unidentified species)

Family Leucospidae
Leucospidae spp. (3 unidentified species)

Family Masaridae
Masaridae spp. (2 unidentified species)
Pseudomasaris vespoides
Pseudomasaris sp.

Family Megachilidae
Anthidium placitum
Anthidium sp.
Ashmeadiella bucconis
Ashmeadiella spp. (2 unidentified species)
Coelioxys hirsufissima
Dianthidium pudicum
Dianthidium subparcrim
Dianthidium sp.
Hoplitis sp.
Megachile conciana
Megachile lobatifrons
Megachile nevadensis
Megachile newberryi
Megachile spp. (3 unidentified species)
Osmia gaudiosa
Osmia spp. (2 unidentified species)

Family Mutillidae
Dasymutilla spp. (3 unidentified species)
Mutillidae spp. (6 unidentified species)
Sphaeropthalma spp. (3 unidentified species)

Family Ormyridae
Ormyridae spp. (2 unidentified species)

Family Perilampidae
Perilampidae spp. (2 unidentified species)

Family Platygasteridae
Platygasteridae spp. (4 unidentified species)

Family Pompilidae
Ageniella species
Anoplius cleora
Anoplius imbellis
Anoplius sp.
Pepsis chrysothemis
Pepsis sp.

Family Proctotrupidae
Proctotrupidae sp.

Family Pteromalidae
Pteromalidae spp. (3 unidentified species)

Family Scelionidae
Scelionidae spp. (6 unidentified species)

Family Scoliidae
Scoliidae sp.

Family Sphecidae
Amophila pruinosa
Amophila wrighti
Bembix americana
Bembix sayi
Bembix sp.
Cerceris californica
Cerceris spp. (4 unidentified species)
Fernaldina lucae
Microbembix sp.
Oxybelus argenteopilosus
Oxybelus spp. (3 unidentified species)
Palmodes sp.
Philanthus spp. (4 unidentified species)
Podalonia argentipilis
Podalonia deserticola
Podalonia sp.
Prionyx foxi
Prionyx parkeri
Prionyx spp. (2 unidentified species)
Sceliphron caementarium
Sphecidae spp. (8 unidentified species)
Sphecius convallis
Sphex ashmeadi
Steniolia duplicata
Tachysphex coquilletti
Tachysphex texanus
Tachysphex spp. (2 unidentified species)
Tachytes erimineus
Tachytes spp. (4 unidentified species)
Trypoxylon californicum

Family Tenthredinidae
Tenthredinidae spp. (5 unidentified species)

Family Tiphiidae
Tiphiidae spp. (11 unidentified species)

Family Torymidae
Torymidae spp. (9 unidentified species)

Family Trichogrammitidae
Thrichogramma kay kai
Thrichogramma deion

Family Vespidae
Eumenes bollii
Leptochilus electus
Leptochilus propodealis
Polistes aurifer
Vespidae spp. (7 unidentified species)

I.3 Reptile and Amphibian Species Known to Occur on NAWS China Lake

Nomenclature follows Crother 2012, Scientific and Standard English Names of Amphibians and Reptiles of North America North of Mexico.

Table I-2. Department of Fish and Game Reptile and Amphibian Special Animals List of those that occur at NAWS-CL. Status Data from California Natural Diversity Database 2011.[1]

Scientific Name	Common Name	Rank	ESA	CESA	Other Status
Gopherus agassizii	Mohave Desert Tortoise	G4 S2	Threatened	Threatened	International Union for Conservation of Nature: Vulnerable
Sceloporus graciosus graciosus	Northern Sagebrush Lizard	G5T5 S3	None	None	Bureau of Land Management: Sensitive
Elgaria panamintina	Panamint Alligator Lizard	G1G2 S1S2	None	None	Bureau of Land Management: Sensitive California Department of Fish and Game: Species of Special Concern International Union for Conservation of Nature: Vulnerable U.S. Fish and Wildlife Service: Sensitive
Charina trivirgata	Rosy Boa	G4G5 S3S4	None	None	International Union for Conservation of Nature: Least Concern U.S. Fish and Wildlife Service: Sensitive

ORDER TESTUDINATA (TORTOISES)

Family Testudinidae
Gopherus agassizii–Mohave Desert Tortoise

[1] G1: Less than 6 viable element occurrences (EOs) OR less than 1,000 individuals OR less than 2,000 acres; G2: 6-20 EOs OR 1,000-3,000 individuals OR 2,000-10,000 acres; G3: 21-100 EOs OR 3,000-10,000 individuals OR 10,000-50,000 acres; G4: Apparently secure; this rank is clearly lower than G3 but factors exist to cause some concern; i.e., there is some threat, or somewhat narrow habitat; G5: Population or stand demonstrably secure to ineradicable due to being commonly found in the world; S1: Less than 6 EOs OR less than 1,000 individuals OR less than 2,000 acres; S2: 6-20 EOs OR 1,000-3,000 individuals OR 2,000-10,000 acres; S3: 21-100 EOs or 3,000-10,000 individuals OR 10,000-50,000 acres; S4: Apparently secure within California; this rank is clearly lower than S3 but factors exist to cause some concern; i.e. there is some threat, or somewhat narrow habitat. NO THREAT RANK; T-rank: status of a subspecies.

ORDER SQUAMATA (SNAKES & LIZARDS)

Family Gekkonidae
Coleonyx variegatus –Western Banded Gecko

Family Iguanidae
Dipsosaurus dorsalis–Desert Iguana
Callisaurus draconoides–Zebra-tailed Lizard
Crotaphytus bicinctores–
Great Basin Collared Lizard
Gambelia wislizenii–Long-nosed Leopard Lizard
Phrynosoma platyrhinos–Desert Horned Lizard
Sauromalus ater–Common Chuckwalla
Sceloporus graciosus–Common Sagebrush Lizard
Sceloporus magister–Desert Spiny Lizard
Sceloporus occidentalis–Western Fence Lizard
Urosaurus graciosus–Long-tailed Brush Lizard
Uta stansburiana–Common Side-blotched Lizard

Family Xantusidae
Xantusia vigilis–Desert Night Lizard

Family Sinkidae
Plestiodon gilberti–Gilbert's Skink

Family Teidae
Aspidoscelis tigris–Tiger Whiptail

Family Anguidae
Elgaria panamintina–Panamint Alligator Lizard

Family Boidae
Lichanura trivirgata–Rosy Boa

Family Colubridae
Arizona elegans–Glossy Snake
Chionactis occipitalis–Western Shovel-nosed Snake
Coluber flagellum–Coachwhip
Coluber taeniatus–Striped Whipsnake
Diadophis punctatus amabilis–
Pacific Ring-necked Snake
Hypsiglena chlorophaea–Desert Nightsnake
Lampropeltis getula–Eastern Kingsnake
Phyllorhynchus decurtatus–
Spotted Leaf-nosed Snake
Pituophis catenifer–Gophersnake
Rena humilis–Western Threadsnake
Rhinocheilus lecontei–Long-nosed Snake
Salvadora hexalepis–Western Patch-nosed Snake
Trimorphodon lyrophanes–California Lyresnake

Family Viperidae
Crotalus cerastes–Sidewinder
Crotalus scutulatus–Mohave Rattlesnake
Crotalus stephensi–Panamint Rattlesnake

ORDER SALIENTIA (FROGS & TOADS)

Family Bufonidae
Anaxyrus boreas–Western Toad

Family Hylidae
Pseudacris regilla–Pacific Treefrog

I.4 Bird Species Known to Occur on NAWS-CL

ORDER GAVIIFORMES (LOONS)

Family Gaviidae
Gavia immer–common loon
Gavia pacifica–Pacific loon

ORDER PODICIPEDIFORMES (GREBES)

Family Podicipedidae
Aechmophorus clarkii–Clark's grebe
Aechmophorus occidentalis–western grebe
Podiceps auritus–horned grebe
Podiceps nigricollis–eared grebe
Podilymbus podiceps–pied-billed grebe

ORDER SULIFORMES (FRIGATEBIRDS, BOOBIES AND CORMORANTS)

Family Phalacrocoracidae
Phalacrocorax auritus–double-crested cormorant

ORDER PELECANIFORMES (PELICANS)

Family Pelecanidae
Pelecanus erythrorhynchos–American white pelican
Pelecanus occidentalis–brown pelican

Family Ardeidae
Ardea alba–great egret
Ardea herodias–great blue heron
Botaurus lentiginosus–American bittern
Bubulcus ibis–cattle egret
Butorides virescens–green heron
Egretta thula–snowy egret
Ixobrychus exilis–least bittern
Nycticorax nycticorax–black-crowned night heron

Family Threskiornithidae
Platalea ajaja–roseate spoonbill
Plegadis chihi–white-faced ibis

ORDER ACCIPITRIFORMES (ACCIPITERS)

Family Cathartidae
Cathartes aura–turkey vulture

Family Pandionidae
Pandion haliaetus–osprey

Family Accipitridae
Accipiter cooperii–Cooper's hawk
Accipiter gentilis–northern goshawk
Accipiter striatus–sharp-shinned 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

ORDER FALCONIFORMES (FALCONS)

Family Falconidae
Falco columbarius–merlin
Falco mexicanus–prairie falcon
Falco peregrinus–Peregrine falcon
Falco sparverius–American kestrel

ORDER ANSERIFORMES (DUCKS, GEESE & SWANS)

Family Anatidae
Aix sponsa–wood duck
Anas acuta–northern pintail
Anas americana–American wigeon
Anas clypeata–northern shoveler
Anas crecca–green-winged teal
Anas cyanoptera–cinnamon teal
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
Branta hutchinsii–cackling goose
Bucephala albeola–bufflehead
Bucephala clangula–common goldeneye
Bucephala islandica–barrow's goldeneye
Chen caerulescens–snow goose
Chen rossi–Ross's goose
Clangula hyemalis–long-tailed duck
Cygnus columbianus–tundra swan
Lophodytes cucullatus–hooded merganser
Melanitta fusca–white-winged scoter
Melanitta perspicillata–surf scoter
Mergus merganser–common merganser
Mergus serrator–red-breasted merganser
Oxyura jamaicensis–ruddy duck

ORDER GALLIFORMES (QUAIL & TURKEYS)

Family Phasianidae
Alectoris chukar–chukar
Meleagris gallopavo–wild turkey
Family Odontophoridae
Callipepla californica–California quail
Callipepla gambelii–Gambel's quail
Oreortyx pictus–mountain quail

ORDER GRUIFORMES (CRANES & RAILS)

Family Rallidae
Fulica americana–American coot
Gallinula chloropus–common moorhen
Porzana carolina–sora
Rallus limicola–Virginia rail

Family Gruidae
Grus canadensis–sandhill crane

ORDER CHARADRIIFORMES (SHOREBIRDS & GULLS)

Family Charadriidae
Charadrius nivosus–snowy plover
Charadrius montanus–mountain plover
Charadrius semipalmatus–semipalmated plover
Charadrius vociferus–killdeer
Pluvialis dominica–American golden plover
Pluvialis fulva–Pacific golden plover
Pluvialis squatarola–black-bellied plover

Family Recurvirostridae
Himantopus mexicanus–black-necked stilt
Recurvirostra americana–American avocet

Family Scolopacidae
Actitis macularius–spotted sandpiper
Arenaria interpres–ruddy turnstone
Arenaria melanocephala–black turnstone
Calidris alba–sanderling
Calidris alpina–dunlin
Calidris bairdii–Baird's sandpiper
Calidris canutus–red knot
Calidris fuscicollis–white-rumped sandpiper
Calidris himantopus–stilt sandpiper
Calidris mauri–western sandpiper
Calidris melanotos–pectoral sandpiper
Calidris minutilla–least sandpiper
Calidris pusilla–semipalmated sandpiper
Calidris ruficollis–red-necked stint
Gallinago delicata–Wilson's snipe
Gallinago gallinago–common snipe
Limnodromus griseus–short-billed dowitcher
Limnodromus scolopaceus–long-billed dowitcher
Limosa fedoa–marbled godwit
Limosa haemastica–Hudsonian godwit
Numenius americanus–long-billed curlew
Numenius phaeopus–whimbrel
Phalaropus fulicarius–red phalarope
Phalaropus lobatus–red-necked phalarope
Phalaropus tricolor–Wilson's phalarope
Philomachus pugnax–ruff
Tringa flavipes–lesser yellowlegs
Tringa glareola–wood sandpiper
Tringa incana–wandering tattler
Tringa melanoleuca–greater yellowlegs
Tringa semipalmata–willet
Tringa solitaria–solitary sandpiper

Family Laridae
Chlidonias niger–black tern
Larus argentatus–herring gull
Larus atricilla–laughing gull
Larus californicus–California gull
Larus canus–mew gull
Larus delawarensis–ring-billed gull
Larus heermanni–Heermann's gull
Larus livens–yellow-footed gull
Larus minutus–little gull
Larus philadelphia–Bonaparte's gull
Larus pipixcan–Franklin's gull
Larus thayeri–Thayer's gull
Rissa tridactyla–black-legged kittiwake
Rynchops niger–black skimmer
Stercorarius parasiticus–parasitic jaeger
Stercorarius pomarinus–pomarine jaeger
Sterna antillarum–least tern
Sterna caspia–Caspian tern
Sterna forsteri–Forster's tern
Sterna hirundo–common tern
Sterna paradisaea–Arctic tern
Xema sabini–Sabine's gull

ORDER COLUMBIFORMES (DOVES & PIGEONS)

Family Columbidae
Columba livia–rock pigeon
Columbina inca–inca dove
Columbina talpacoti–ruddy ground dove
Patagioenas fasciata–band-tailed pigeon
Streptopelia decaocto–Eurasian collared dove
Zenaida asiatica–white-winged dove
Zenaida macroura–mourning dove

ORDER CUCULIFORMES (CUCKOOS)

Family Cuculidae
Coccyzus americanus–yellow-billed cuckoo
Geococcyx californianus–greater roadrunner

ORDER STRIGIFORMES (OWLS)

Family Tytonidae
Tyto alba–barn owl

Family Strigidae
Aegolius acadicus–northern saw-whet owl
Asio flammeus–short-eared owl
Asio otus–long-eared owl
Athene cunicularia–burrowing owl
Bubo virginianus–great horned owl
Glaucidium gnoma–northern pygmy owl
Megascops kennicottii–western screech owl
Otus flammeolus–flammulated owl

ORDER CAPRIMULGIFORMES (NIGHTHAWKS)

Family Pteroclidae
Chordeiles acutipennis–lesser nighthawk
Chordeiles minor–common nighthawk
Phalaenoptilus nuttallii–common poorwill

ORDER APODIFORMES (SWIFTS AND HUMMINGBIRDS)

Family Apodidae
Aeronautes saxatalis–white-throated swift
Chaetura pelagica–chimney swift
Chaetura vauxi–Vaux's swift
Cypseloides niger–black swift

Family Trochilidae
Archilochus alexandri–black-chinned hummingbird
Calypte anna–Anna's hummingbird
Calypte costae–Costa's hummingbird
Cynanthus latirostris–broad-billed hummingbird
Selasphorus calliope–calliope hummingbird
Selasphorus platycercus–broad-tailed hummingbird
Selasphorus rufus–rufous hummingbird
Selasphorus sasin–Allen's hummingbird

ORDER CORACIIFORMES (KINGFISHERS)

Family Alcedinidae
Ceryle alcyon–belted kingfisher

ORDER PICIFORMES (WOODPECKERS & SAPSUCKERS)

Family Picidae
Colaptes auratus–northern flicker
Melanerpes formicivorus–acorn woodpecker
Melanerpes lewis–Lewis's woodpecker
Picoides albolarvatus–white-headed woodpecker
Picoides nuttallii–Nuttall's woodpecker
Picoides pubescens–downy woodpecker
Picoides scalaris–ladder-backed woodpecker
Picoides villosus–hairy woodpecker
Sphyrapicus nuchalis–red-naped sapsucker
Sphyrapicus ruber–red-breasted sapsucker
Sphyrapicus thyroideus–Williamson's sapsucker

Sphyrapicus varius–yellow-bellied sapsucker

ORDER PASSERIFORMES (SONGBIRDS)

Family Tyrannidae
Contopus cooperi–olive-sided flycatcher
Contopus sordidulus–western wood-pewee
Empidonax difficilis–Pacific-slope flycatcher
Empidonax hammondii–Hammond's flycatcher
Empidonax minimus–least flycatcher
Empidonax oberholseri–dusky flycatcher
Empidonax traillii extimus–
southwestern willow flycatcher [FT]
Empidonax wrightii–gray flycatcher
Myiarchus cinerascens–ash-throated flycatcher
Myiarchus tyrannulus–brown-crested flycatcher
Pyrocephalus rubinus–vermillion flycatcher
Sayornis nigricans–black phoebe
Sayornis saya–Say's phoebe
Tyrannus forficatus–scissor-tailed flycatcher
Tyrannus tyrannus–eastern kingbird
Tyrannus verticalis–western kingbird
Tyrannus vociferans–Cassin's kingbird

Family Laniidae
Lanius excubitor–northern shrike
Lanius ludovicianus–loggerhead shrike
Aphelocoma californica–western scrub-jay
Corvus brachyrhynchos–American crow
Corvus corax–common raven
Cyanocitta stelleri–Stellar's jay
Gymnorhinus cyanocephalus–pinyon jay
Nucifraga columbiana–Clark's nutcracker
Pica hudsonia–black-billed magpie

Family Vireonidae
Vireo bellii pusillus–least Bell's vireo [FE, SE]
Vireo cassinii–Cassin's vireo
Vireo gilvus–warbling vireo
Vireo griseus–white-eyed vireo
Vireo olivaceus–red-eyed vireo
Vireo plumbeus–plumbeous vireo
Vireo solitarius–blue-headed vireo

Family Alaudidae
Eremophila alpestris–horned lark

Family Hirundinidae
Hirundo rustica–barn swallow
Petrochelidon pyrrhonota–cliff swallow
Progne subis–purple martin
Riparia riparia–bank swallow
Stelgidopteryx serripennis–
northern rough-winged swallow
Tachycineta bicolor–tree swallow
Tachycineta thalassina–violet-green swallow

Family Remizidae
Auriparus flaviceps–verdin

Family Paridae
Baeolophus inornatus–oak titmouse
Poecile gambeli–mountain chickadee

Family Aegithalidae
Psaltriparus minimus–bushtit

Family Sittidae
Sitta canadensis–red-breasted nuthatch
Sitta carolinensis–white-breasted nuthatch
Sitta pygmaea–pygmy nuthatch

Family Certhiidae
Certhia americana–brown creeper

Family Troglodytidae
Campylorhynchus brunneicapillus–cactus wren
Catherpes mexicanus–canyon wren
Cistothorus palustris–marsh wren
Salpinctes obsoletus–rock wren
Thryomanes bewickii–Bewick's wren
Troglodytes aedon–house wren
Troglodytes pacificus–Pacific wren

Family Regulidae
Regulus calendula–ruby-crowned kinglet
Regulus satrapa–golden-crowned kinglet

Family Sylviidae
Polioptila caerulea–blue-gray gnatcatcher
Polioptila melanura–black-tailed gnatcatcher

Family Turdidae
Catharus guttatus–hermit thrush
Catharus ustulatus–Swainson's thrush
Hylocichla mustelina–wood thrush
Ixoreus naevius–varied thrush
Myadestes townsendi–Townsend's solitaire
Sialia currucoides–mountain bluebird
Sialia mexicana–western bluebird
Turdus migratorius–American robin

Family Timaliidae
Chamaea fasciata–wrentit

Family Mimidae
Dumetella carolinensis–gray catbird
Mimus polyglottos–northern mockingbird
Oreoscoptes montanus–sage thrasher
Toxostoma crissale–crissal thrasher
Toxostoma lecontei–Le Conte's thrasher
Toxostoma redivivum–California thrasher
Toxostoma rufum–brown thrasher

Family Sturnidae
Sturnus vulgaris–European starling

Family Motacillidae
Anthus cervinus–red-throated pipit
Anthus rubescens–American pipit
Anthus spinoletta–water pipit
Anthus spragueii–Sprague's pipit

Family Bombycillidae
Bombycilla cedrorum–cedar waxwing
Bombycilla garrulus–Bohemian waxwing
Phainopepla nitens–phainopepla

Family Parulidae
Geothlypis formosa–Kentucky warbler
Geothlypis philadelphia–mourning warbler
Geothlypis tolmiei–MacGillivray's warbler
Geothlypis trichas–common yellowthroat
Icteria virens–yellow-breasted chat
Mniotilta varia–black-and-white warbler
Myioborus pictus–painted redstart
Oporornis agilis–Connecticut warbler
Oreothlypis celata–orange-crowned warbler
Oreothlypis luciae–Lucy's warbler
Oreothlypis peregrina–Tennessee warbler
Oreothlypis ruficapilla–Nashville warbler
Oreothlypis virginiae–Virginia's warbler
Protonotaria citrea–prothonotary warbler
Seiurus aurocapilla–ovenbird
Seiurus noveboracensis–northern waterthrush
Setophaga americana–northern parula
Setophaga caerulescens–black-throated blue warbler
Setophaga castanea–bay-breasted warbler
Setophaga citrina–hooded warbler
Setophaga coronata–yellow-rumped warbler
Setophaga discolor–prairie warbler
Setophaga fusca–blackburnian warbler
Setophaga magnolia–magnolia warbler
Setophaga nigrescens–black-throated gray warbler
Setophaga occidentalis–hermit warbler
Setophaga palmarum–palm warbler
Setophaga pensylvanica–chestnut-sided warbler
Setophaga petechia–yellow warbler
Setophaga ruticilla–American redstart
Setophaga striata–blackpoll warbler
Setophaga townsendi–Townsend's warbler

Family Cardinalidae
Cardellina pusilla–Wilson's warbler

Family Emberizidae
Aimophila ruficeps–rufous-crowned sparrow
Ammodramus leconteii–Le Conte's sparrow
Ammodramus savannarum–grasshopper sparrow
Artemisiospiza belli–sage sparrow
Amphispiza bilineata–black-throated sparrow
Calamospiza melanocorys–lark bunting
Calcarius lapponicus–lapland longspur
Calcarius ornatus–chestnut-collared longspur
Chondestes grammacus–lark sparrow
Junco hyemalis–dark-eyed junco
Melospiza georgiana–swamp sparrow
Melospiza lincolnii–Lincoln's sparrow
Melospiza melodia–song sparrow
Passerculus sandwichensis–savannah sparrow
Passerella iliaca–ox sparrow
Pipilo chlorurus–green-tailed towhee
Pipilo crissalis–California towhee
Pipilo crissalis eremophilus–Inyo California towhee [SE, FE]
Pipilo erythrophthalmus–eastern towhee
Pipilo maculatus–spotted towhee
Piplio fuscus–canyon towhee
Pooecetes gramineus–vesper sparrow
Spizella arborea–American tree sparrow
Spizella atrogularis–black-chinned sparrow
Spizella breweri–Brewer's sparrow
Spizella pallida–clay-colored sparrow
Spizella passerina–chipping sparrow
Spizella pusilla–field sparrow
Zonotrichia albicollis–white-throated sparrow
Zonotrichia atricapilla–golden-crowned sparrow
Zonotrichia leucophrys–white-crowned sparrow
Zonotrichia querula–Harris's sparrow

Family Cardinalidae
Passerina caerulea–blue grosbeak
Passerina amoena–lazuli bunting
Passerina cyanea–indigo bunting
Passerina ciris–painted bunting
Pheucticus ludovicianus–rose-breasted grosbeak
Pheucticus melanocephalus–black-headed grosbeak
Piranga ludoviciana–western tanager

Piranga olivacea–scarlet tanager
Piranga rubra–summer tanager
Spiza americana–dickcissel

Family Icteridae
Agelaius phoeniceus–red-winged blackbird
Agelaius tricolor–tricolored blackbird
Dolichonyx oryzivorus–bobolink
Euphagus carolinus–rusty blackbird
Euphagus cyanocephalus–Brewer's blackbird
Icterus bullockii–Bullock's oriole
Icterus cucullatus–hooded oriole
Icterus galbula–Baltimore oriole
Icterus parisorum–Scott's oriole
Icterus spurius–orchard oriole
Molothrus aeneus–bronzed cowbird
Molothrus ater–brown-headed cowbird
Quiscalus mexicanus–great-tailed grackle
Sturnella neglecta–western meadowlark
Xanthocephalus xanthocephalus–
yellow-headed blackbird

Family Fringillidae
Carduelis lawrencei–Lawrence's goldfinch
Carduelis pinus–pine siskin
Carduelis psaltria–lesser goldfinch
Carduelis tristis–American goldfinch
Haemorhous cassinii–Cassin's finch
Haemorhous mexicanus–house finch
Haemorhous purpureus–purple finch
Coccothraustes vespertinus–evening grosbeak
Loxia curvirostra–red crossbill

Family Passeridae
Passer domesticus–house sparrow

ST = State-listed Threatened; FT = Federally-Listed Threatened; CSC = California Species of Concern.
Status Data from CNDDB 2006.

I.5 Mammal Species Known to Occur on NAWS-CL

ORDER RODENTIA (RODENTS)

Family Cricetidae
*Microtus s*p.–vole
Neotoma fuscipes–dusky-footed woodrat
Neotoma lepida–desert woodrat
Onychomys torridus–southern grasshopper mouse
Peromyscus boylii–brush mouse
Peromyscus crinitus–canyon mouse
Peromyscus eremicus–cactus mouse
Peromyscus maniculatus–deer mouse
Peromyscus truei–pinyon mouse
Reithrodontomys megalotis–western harvest mouse

Family Erethizontidae
Erethizon dorsatum–North American porcupine

Family Geomyidae
Thomomys bottae–Botta's pocket gopher

Family Heteromyidae
Chaetodipus formosus–long-tailed pocket mouse
Chaetodipus penicillatus–desert pocket mouse
Dipodomys deserti–desert kangaroo rat
Dipodomys merriami–Merriam's kangaroo rat
Dipodomys microps–chisel-toothed kangaroo rat
Dipodomys panamintinus–Panamint kangaroo rat
Perognathus longimembris–little pocket mouse

Family Scuiridae
Ammospermophilus leucurus–
white-tailed antelope squirrel
Eutamias panamintinus–Panamint chipmunk
Perognatus parvus–Great Basin pocket mouse
Otospermophilus beecheyi–
California ground squirrel
Xerospermophilus mohavensis–
Mohave ground squirrel [ST]

ORDER LAGOMORPH (RABBITS)

Family Leporidae
Lepus californicus–black-tailed jackrabbit
Sylvilagus audubonii–desert cottontail

ORDER INSECTIVORA (SHREWS)

Family Soricidae
Notiosorex crawfordi–desert shrew

ORDER CHIROPTERA (BATS)

Family Molossidae
Eumops perotis–western mastiff bat [CSC]
Tadarida brasiliensis–Mexican free-tailed bat

Family Vespertilionidae
Antrozous pallidus–pallid bat [CSC]
Corynorhinus townsendii–
Townsend's big-eared bat [CSC]
Eptesicus fuscus–big brown bat
Euderma maculatum–spotted bat [CSC]
Lasionycteris noctivagans–silver-haired bat*
Lasiurus blossevillii–western red bat*
Lasiurus cinereus–hoary bat*
Myotis californicus–California myotis
Myotis ciliolabrum–western small-footed myotis
Myotis evotisvlong-eared myotis*
Myotis lucifugus–little brown myotis
Myotis thysanodes–fringed myotis
Myotis volans–long-legged myotis
Myotis yumanensis–Yuma myotis*
Pipistrellus hesperus–western pipistrel

ORDER CARNIVORA (CARNIVORANS)

Family Canidae
Canis latrans–coyote
Urocyon cinereoargenteus–common gray fox
Vulpes macrotis–desert kit fox

Family Fedlidae
Felis concolor–mountain lion
Lynx rufus–bobcat

Family Mustelidae
Mephitis mephitis–striped skunk
Taxidea taxus–American badger [CSC]

Family Procyonidae
Bassariscus astutus–ringtail
Procyon lotor–common raccoon

ORDER PERISSODACTYLA (ODD-TOED UNGULATES)

Family Equidae
Equus asinus–feral burro (I)
Equus caballus–feral horse (I)

ORDER ARTIODACTYLA (EVEN-TOED UNGULATES)

Family Bovidae
Ovis canadensis nelsoni–desert bighorn sheep (R)

Family Cervidae
Odocoileus hemionus–mule deer

Notes: * Species of potential occurrence on NAWS-CL.
(I) Introduced species; (R) Reintroduced species; CSC = California Species of Concern; ST = State-listed as Threatened
Status data taken from CNDDB 2006.

Appendix J: NAWS-CL Special Status Species

This Integrated Natural Resources Management Plan (INRMP) is intended to maintain a relevant and updated baseline list of plant and animal species, located at Naval Air Weapons Station China Lake (NAWS-CL), for all pertinent taxonomic and regionally important groups (U.S. Department of Defense Instruction 4715.03 18 March 2011). This includes special status species and management indicator species from federal agencies, such as the Bureau of Land Management (BLM) and U.S. Fish and Wildlife Service, as well as private organizations and societies, such as California Native Plant Society (CNPS).

The majority of the information within this Appendix was taken from the accounts of potentially sensitive species in the previous INRMP (INRMP 2000). This document relied primarily on the California Natural Diversity Database and experts familiar with species occurring on NAWS-CL (INRMP 2000).

J.1 Special Status Plant Species

J.1.1 Plants Confirmed to Occur at NAWS-CL

Great Basin Onion. Great Basin onion (Allium atrorubens var. atrorubens) is a perennial herb from a bulb. This species has a CNPS Plant Rank of 2, given to plants that CNPS considers rare, threatened, or endangered in California, but more common elsewhere. It grows in rocky or sandy cryptogam-binded soils from 3,960 to 7,640 feet (1,207–2,329 meters [m]) above mean sea level (AMSL). Great Basin onion has been reported on the NAWS-CL North Range by Dave Silverman (2008) in Blackbrush-Yucca Scrub 3.72 miles (6 kilometers [km]) southeast of Coso Peak, 115 miles (185 km) west-southwest of Darwin Spring (CNPS 2011).

Pinyon Rock Cress. Pinyon rock cress (*Arabis dispa; Boechera d.)* is an upright, perennial herb in the mustard family. This species has a CNPS Plant Rank of 2. It usually grows on loose, gravelly slopes or on compact talus slopes, from 4,000 to 8,000 feet (1,219–2,438 m) AMSL. Pinyon rock cress is reported by DeDecker (1980) as infrequent in the Coso and Argus Ranges from 5,000 to 7,600 feet (1,524–2,316 m) AMSL. Recent records at NAWS-CL include sparse populations (less than ten plants) at Birchum Mesa, southern Etcheron Valley, and the El Conejo Gate (Navy 1997).

Darwin Mesa Milkvetch. Darwin Mesa milkvetch (*Astragalus atratus* var. *mensanus*) is a delicate herbaceous perennial. The variety mensanus, occurring in the northern Mojave Desert, is geographically isolated from the rest of the species, which occur mostly in the Great Basin Desert. Darwin Mesa milkvetch has a CNPS Plant Rank of 1B, plants that CNPS considers rare, threatened, or endangered in California and elsewhere. It occurs on open flats and hillsides, between 5,800 and 7,800 feet (1,768–2,377 m) AMSL in volcanic clay and gravel. It usually occurs among low scrub formations associated with Blackbush Scrub, Joshua Tree Woodland, Sagebrush Scrub, and Pinyon Woodland. The NAWS-CL populations occur in the Coso Peak, El Conejo, and southern Etcheron Valley areas. Only one other population (Hunter Mountain) outside NAWS-CL is currently known (Navy 1997).

Booth's Evening Primrose. Booth's evening primrose (*Camissonia boothii* subsp. *boothii*) is a late spring annual. It is a common plant in western Nevada between 2,500 and 4,500 feet (762–1,372 m) AMSL. This species has a CNPS Plant Rank of 2. This species is suspected to exist on NAWS-CL at Cinder Peak, Volcano Peak, Sugarloaf, Coso Geothermal Area, Haiwee Spring, and Cactus Flat (Navy 1997).

Desert Bird's-Beak. Panamint bird's-beak (*Cordylanthus eremicus* subsp. *eremicus*) is a late blooming annual species. This species has a CNPS Plant Rank of 4, given to plants that CNPS considers of limited distribution (a watch list). Panamint bird's beak grows from 4,900 to 8,400 feet (1,494–2,560 m) AMSL, in Sagebrush Scrub and Pinyon Woodland. It is endemic to the Coso, Argus, Nelson, San Bernardino, and Panamint Ranges. This species is widespread and locally abundant in high elevations of the NAWS-CL North Range, ranging from 5,000 feet (1,524 m) AMSL in the Moscow Spring area, extending to the western flanks of Maturango Peak and throughout the Coso Range, up to 8,000 feet (2,438 m) AMSL. A 1993 survey found the Desert Bird's-Beak extremely abundant in many areas and widespread in both the Argus and Coso Ranges (Navy 1997).

Clokey's Cryptantha. Clokey's cryptantha (*Cryptantha clokeyi*) is a branching annual with hairy stems and leaves and small white flowers. It grows in sandy or gravelly soils in Creosote Bush Scrub or Mojave Mixed Scrub at 3,000 to 4,500 feet (914–1,372 m) AMSL. This species has a CNPS Plant Rank of 1B. It was observed, but not confirmed, on the South Range at NAWS-CL (Silverman 1998).

Desert Cymopterus. Desert cymopterus (*Cymopterus deserticola*) is an herbaceous perennial grayish-green leaves and purple flowers. It grows in deep, loose, well drained, fine to coarse sandy soils of alluvial fans and basins, often in swales or stabilized low s and dune areas and occasionally on sandy slopes. The known elevation range of this species is 2,060-3,060 feet (692-933 m) AMSL. It occurs in Mojave Creosote Bush Scrub, Desert Saltbush Scrub, and Joshua Tree Woodland with Creosote Bush Scrub or Desert Saltbush Scrub understory. This species has a CNPS Plant Rank of 1B.2. It is known from Superior Valley, approximately 0.5 miles south of NAWS-CL, and from Cuddeback Dry Lake area. It is expected to occur in NAWS-CL East Superior Valley, southwest of Goldstone. It is mostly known from Fremont Valley, south of Harper Lake, west, to Edwards Air Force Base (BLM 2013; CNPS 2011).

Panamint Dudleya. Panamint dudleya (*Dudleya saxosa* subsp. *saxosa*) is a small succulent perennial of the Stonecrop family (Crassulaceae). It occurs only in the Panamint Mountains from Augerberry Point in the north to Arrastre Springs in the south. It occurs between 3,000 and 7,100 feet (914–2,164 m) AMSL, in Creosote Bush Scrub and Pinyon Woodland. It is usually restricted, but locally common, growing on dry stony slopes, boulder areas and crevices in granitic or carbonate soils. This species is a federal species of concern, and has a CNPS Plant Rank of 1B. An unconfirmed BLM report from 1980 indicates this taxon at NAWS-CL, on Pilot Knob in the Mojave B South (Navy 1997).

Pinyon Mesa Buckwheat. Pinyon Mesa buckwheat (*Eriogonum mensicola*) is a late blooming subshrub. This species has a CNPS Plant Rank of 1B. There are 14 known occurrences in California. It occurs in rocky or gravelly soils, at 7,244 feet (2,208 m) AMSL in Pinyon-Juniper Woodland, Great Basin Scrub, and Upper Montane Coniferous Forest. Pinyon Mesa buckwheat has been reported on the NAWS-CL North Range by G.F. Pratt (1997) (CNPS 2011).

Panamint Mountains Buckwheat. Panamint Mountains buckwheat (*Eriogonum microthecum* var. *panamintense*) is a late blooming shrub. This species has a CNPS Plant Rank of 1B. There are 11 known occurrences in California. It grows between 5,940 and 7,240 feet (1,810–2,207 m) AMSL on steep, rocky mountain slopes of decomposed granite soils in Pinyon Woodland. Panamint Mountains buckwheat has been

reported by A.C. Sanders (1997) on the NAWS-CL North Range in the Argus Range, on east and south sides of Parkinson Peak, about 1.5 miles (2.4 km) southeast of Maturango Peak (CNPS 2011).

Yerba Desierto. Yerba desierto (*Fendlerella utahensis*) is a low, highly branched erect shrub with shreddy bark with small, white flowers. It occurs on dry limestone slopes between 5,000 and 8,400 feet (1,524–2,560 m) AMSL, in Shadescale Scrub, Mixed Desert Scrub, Sagebrush Scrub, and Pinyon Woodland. It occurs throughout the southwest and in the mountains of the northern and eastern Mojave Desert. This species has a CNPS Plant Rank of 4. On NAWS-CL, it has been observed in the Maturango Peak area (DeDecker 1980). Potential distribution on NAWS-CL would be in limestone areas of the northern Argus Range, although not much of the potential habitat has been surveyed (Navy 1997).

Inyo Hulsea. Inyo hulsea (*Hulsea vestita* subsp. *inyoensis*) occurs on steep slopes of unstable substrate, composed of dark slate, shale, or volcanic soils, between 4,600 and 7,600 feet (1,402–2,316 m) AMSL, in Mixed Desert Scrub, Sagebrush Scrub, and Pinyon Woodland. Inyo hulsea is a low, herbaceous biennial or perennial with yellow ray and disk flowers. It occurs in the Grapevine, Cottonwood, Inyo, and Coso Mountains in California. This species has a CNPS Plant Rank of 2. On NAWS-CL, only one collection appears to have been made in the canyon next to and south of Crystal Spring in the Coso Mountains. Potential habitat on NAWS-CL is in disturbed areas and unstable slopes of coarse soil in the Coso and Argus Ranges above about 5,000 feet (1,524 m) AMSL (Navy 1997).

Creosote Clones. Creosote bush (*Larrea tridentata*) is an evergreen shrub with dark green leaves and produces yellow, five-petal flowers. Reproducing asexually to produce creosote rings, they live extremely long, having been documented to be some of the oldest-living organisms in the world. This species does not have a CNPS Plant Rank. NAWS-CL has one of the largest concentrations of creosote rings in the Mojave Desert. The largest number of creosote rings are found in the heavy sand deposits and sand dunes along the southern portion of the Argus Range near the K-2 Range. The creosote rings often grow to diameters in excess of 40 feet (12.2 m). It has been estimated that these creosote rings are 6,000 to 8,000 years in age. For example, one clone, King Clone, is approximately 72 feet (21.9 m) in diameter and has been estimated to be approximately 11,700 years old (Michael Brandman Associates, Inc. 1989).

Coso Mountains Lupine. Coso Mountains lupine (*Lupinus magnificus* var. *glarecola*) is a low growing herbaceous perennial with a tall and colorful spike of purplish blue flowers. It grows between 5,000 and 8,000 feet (1,524–2,438 m) AMSL in Joshua Tree Woodland, Sagebrush Scrub, Blackbush Scrub, and Pinyon Woodland. It is infrequent on the slopes of the eastern Sierra Nevada. This species has a CNPS Plant Rank of 4. It has been found at NAWS-CL throughout higher elevations in the Coso Range, including Upper Centennial Flat, Coso Peak, Silver Peak, the El Conejo Gate, and Louisiana Butte areas. The species has been successful at colonizing road cuts at NAWS-CL, especially on Louisiana Butte (Navy 1997).

Creamy Blazing Star. Creamy blazing star (*Mentzelia tridentata*) is a spreading to erect annual herb, with medium-sized cream-white petals. It occurs in rocky, gravelly, and sandy soils in Mojave Desert Scrub between 2,310 and 3,828 feet (704–1,167 m) AMSL. This species has a CNPS Plant Rank of 1B. There are 18 known occurrences in California. It is threatened by vehicles, mining, and grazing. Creamy blazing star has been reported by Dave Silverman (1998) on the southwest lower slope of Cinder Peak (in the southwest Coso Mountains at NAWS-CL), about 5.59 miles (9 km) east of Little Lake (CNPS 2011).

Crowned Muilla. Crowned muilla (*Muilla coronata*) is a small bulb forming member of lily family that resembles some onion (*Allium spp.*) species. Crowned muilla prefers rocky to clayey soils in Joshua Tree Woodland, Mojave Mixed Scrub, Creosote Bush Scrub, and Mojave-Great Basin transition communities. This species has a CNPS Plant

Rank of 4. At NAWS-CL, this species has been documented in the Devil's Kitchen site in the Coso Geothermal area. DeDecker (1980) reported occasional populations in the Coso and Argus Ranges, from 3,000 to 5,700 feet (914–1,737 m) AMSL. This species should be expected on the South Range (Navy 1997).

Oppressed Muhly. Oppressed muhly (*Muhlenbergia appressa*) is an annual herb that occurs in coastal scrub, Mojave desert scrub, and valley and foothill grassland habitats at elevations between 20–1,600 m. This species has a CNPS Plant Rank of 2.2. At NAWS-CL, this species is known from one occurrence at Seep Springs. This species is also known from widely scattered sites from San Clemente Island and in the Colorado deserts into Arizona (CNPS 2011).

Amargosa Beardtongue. Amargosa beardtongue (*Penstemon fruticifolrmis* var. *amargosae*) is a highly-branched perennial herb or non-woody shrub. It has purple flowers with a whitish throat and blooms in the spring. It occurs in rocky, gravelly, and sandy soils in Mojave Desert Scrub between 2,600 and 4,600 feet (792–1,402 m) AMSL. This species has a CNPS Plant Rank of 1B. There are 18 known occurrences in California. It is also threatened in Nevada. Amargosa beardtongue has been reported by G.F. Pratt (1995) in the Argus Range on NAWS-CL North Range, near Birchum Springs. This plant is a host of the silvery blue butterfly (*Glaucophysyche lygdamus*) (CNPS 2011).

Mono County Phacelia. Mono County phacelia (*Phacelia monoensis*) is an annual herb that occurs in Pinyon and Juniper Woodland, Great Basin Scrub, clay, roadsides, and alkaline meadows at elevations between 1,900–2,900 m AMSL. This species has a CNPS Plant Rank of 1B.1. There are less than 20 known occurrences in California. It is rare on basalt disturbances in the upper elevations of the Coso Mountains. The species is only known elsewhere in California from Mono County, in the Bridgeport/Bodie area, into Nevada where it is rare. Its relationship with P. inyoensis needs study.

Death Valley Round-Leaved Phacelia. Death Valley round-leaved phacelia (*Phacelia mustelina*) is a small, branching annual with little, violet flowers, and a strong, disagreeable odor. It is found in crevices and ledges on granitic, volcanic, and limestone rock outcrops and cliffs, between 300 and 6,000 feet (91–1,829 m) AMSL, in Creosote Bush Scrub, Mixed Desert Scrub, Sagebrush Scrub, and Pinyon Woodland. This species has a CNPS Plant Rank of 1B. On NAWS-CL, it is known at two locations, near Granite Wells and Seep Spring in Mojave B South. It could potentially occur in appropriate habitat in the Argus Range, the Mojave B, and Randsburg Wash areas (Navy 1997).

Charlotte's Phacelia. Charlotte's phacelia (*Phacelia nashiana*) is a federal species of concern and has a CNPS Plant Rank of 1B. Charlotte's phacelia is an annual flowering plant with cobalt blue flowers. It appears to be limited to volcanic soils along the western boundary of the North Range (Navy 1989, 1997).

Mojave Indigo Bush. Mojave indigo bush (*Psorothamnus arborescens* var. *arborescens*) is a low to medium-sized legume shrub. This taxon occurs in washes and upper bajada slopes of the central Mojave region, from east of Barstow, west to Randsburg and north into NAWS-CL. The dense populations are most commonly associated with wide washes of decomposed granite. This taxon has a CNPS Plant Rank of 4. The populations at NAWS-CL occur above 2,500 feet (762 m) AMSL and are restricted to well-drained upper washes and alluvial terraces in Mojave Mixed Scrub, Joshua Tree Woodland, and Blackbush Scrub. The distribution for Mojave indigo bush at NAWS-CL includes all appropriate habitat south of Randsburg Wash (Navy 1997).

Mojave Fish-Hook Cactus. Mojave fish-hook cactus (*Sclerocactus polyancistrus*) has a CNPS Plant Rank of 4. At NAWS-CL, Mojave fish-hook cactus occurs on the low granitic hills adjacent to Etcheron Valley, southeast of Coso Peak, Louisiana Butte, at Pink Hill, and near Renegade Canyon between 3,000 and 7,600 feet (914–2,316

m) AMSL. This species is found throughout the South Range with a large, almost continuous, population in the western portion of Mojave B South (Navy 1982, 1997).

DeDecker's Clover. DeDecker's clover (*Trifolium macilentum* var. *dedeckerae*) is a low, herbaceous perennial with a loose crown of tripinnate leaves and distinctively arid-adapted features. This plant is known in the eastern Sierra Nevada. The sites represent a range of plant communities from Pinyon Woodland to Alpine crests, 6,900 to 11,500 feet (2,103–3,505 m) AMSL, usually growing in rock crevices. This species has a CNPS Plant Rank of 1B. A likely perennial, *Trifolium* species was recently located northeast of Coso Peak. The population consists of approximately 100 plants on an upper slope of metamorphic granite at 7,500 feet (2,286 m) AMSL. Further determinations and collections need to be completed (Navy 1997).

J.2 Special Status Animal Species

J.2.1 Invertebrates

Fairy Shrimp. Ephemeral playa and clay pan habitats support many invertebrates, including several species of fairy shrimp. The giant fairy shrimp (*Branchinecta gigas*) was reviewed as a species of special concern in 1982 (Eng 1982). Due to this review and concerns for its habitat throughout California, it has been included as a NAWS-CL Management Focus Species. Giant fairy shrimp are found in at least four locations on NAWS-CL: Mirror Lake, China Lake, north of China Lake on the west side of G-2 Tower Road, and at the intersection of G-l Tower Road and Range Access Road. Other species of fairy shrimp, *B. mackini* and *B. lindahli*, are also located on NAWS-CL. These species were collected from Mirror Lake, China Lake, the west end of Airport Lake, and several unnamed playas near the G-1 Tower Road during a study of invertebrates in temporary pools and playa lakes (California Department of Fish and Game 1983).

Jerusalem Crickets. A Jerusalem cricket species (*Stenopelmatus* sp.) has been located on NAWS-CL; however, studies to determine the specific species have not been conducted. It should be regarded as an endemic species with a limited distribution and therefore potentially sensitive. It may ultimately be afforded legal protection. The family taxonomy is currently being reviewed and what are currently considered to be only a few species may actually be many species. On NAWS-CL, Jerusalem crickets may be found throughout creosote bush scrub, but are probably most common in sandy areas such as the K-2 track area. Weissman has conducted work in the K-2 area and other sandy areas around China Lake on the North Range. The species may also be present in riparian areas (Navy 1997).

Dune Cockroaches. Two species of dune cockroaches (*Arenavaga* spp.) have been found in the vicinity of Birchum Springs. The taxonomy of these species is currently unresolved. Because they are wingless, they cannot move great distances and are likely an endemic species or subspecies which may ultimately receive legal protection (Navy 1997).

Darwin Tiemann's Beetle. Darwin Tiemann's beetle (*Megacheuma brevipennis tiemannii*) is a wide ranging species known from scattered localities in the Great Basin regions of Idaho, eastern Oregon, north-central Nevada, Utah, and recently discovered populations in the Fish Lake and China Lake basins in California. On NAWS-CL, it is associated with its host plant, Parry saltbush; thus, its distribution is associated with areas surrounding the China Lake playa, and potentially the Airport Lake playa, Paxton Ranch, the Baker Range playas, and the Magazine playa. As such, it may qualify for state and/or federal listing as a threatened or possible endangered species due to its limited distribution (Navy 1997). There has been some indication that the subspecies on NAWS-CL deserves specific status. A paper has been completed raising *M. b. tiemannii* to species level. As such, it should be regarded as an endemic species with a limited distribution (Navy 1997).

J.2.1.1 Other Invertebrates Considered

Weevils. Dune weevils (*Trigonoscuta* sp.) have been collected at all dune sites visited by Derham Giuliani on NAWS-CL. There may be more than one species present on NAWS-CL, as species collected are undescribed. Specimens collected by Derham Giuliani are stored at the Department of Food and Agriculture in Sacramento, California and are awaiting further study by specialists in the various groups. A dune miloderes has also been found by Giuliani that seems to be restricted to two or three dune sites from Pilot Knob Valley to Wingate Dunes.

A potential impact to these species is habitat degradation. Dune systems require a source of sand, and these sources must be maintained so dunes can continue to be replenished. Constraints to NAWS-CL activities due to the presence of dune weevils are expected to be minimal because few activities are conducted within dune areas. Weevils also appear to be widely distributed. Some question remains as to taxonomy and number of species on NAWS-CL.

Butterflies. Pratt and Pierce (1995) have provided a list of more than 80 species of butterflies found during a five-year survey period on NAWS-CL. Dr. Pratt considers nine of these species as sensitive. All of the species are found on the North Range, and most are associated with small areas of habitat.

Some species exhibit superdiapause (e.g., *Euphilotes*) in the pupal stage and do not occur for a successive number of years (especially during periods of low rainfall). This behavior can last as long as six years and is an adaptation to desert conditions, which allows butterflies to survive on limited plant resources through years with bad conditions. Surveys conducted over several successive years are necessary to be relatively certain of a butterfly's absence. If food plants are in relatively good condition, at least a few representatives of a particular species should be present.

Butterflies are often uniquely timed to phenology, such as flowering or bud break of their food plants. For example, *Euphilotes* emergence and activity follows the blooming phenology of their host *Eriogonum*. If their host blooms in late summer, adult butterflies associated with Eriogonum occur during late summer. Table J-1 lists sensitive species of butterflies, host plants, and potential impacts at NAWS-CL.

Table J-1. Sensitive butterflies, host plants and potential impacts at Naval Air Weapons Station China Lake.

Species	Host Plant	NAWS-CL Potential Impacts
Plebejulina emigdionis	*Atriplex canescens* in association with the ant *Formica pilicornis*	Near El Conejo Gate
Icaricia icarioides (new subspecies)	*Lupinus* spp. (Perennials, especially *Lupinus excubitus*)	None
Euphilotes baueri (=battiodes) vernalis	*Eriogonum kennedeyi*	None
Euphilotes pallescens	*Eriogonum baileyi*	Target sites
Satyrium silvinus	*Salix lasiolepis*	Riparian degradation by horses and cattle
Lycaena arota	*Ribes velutinum*	None
Poladryas arachne	*Penstemon speciosus*	Target sites
Cercyonis sthenele	Bunch grasses (species unknown)	Cattle and horses removing host species
Pholisora alpheus	*Atriplex canescens*	None

Although none of these species are listed by the California Natural Diversity Database, there are three which investigators have indicated merit special mention. The San Emigido blue butterfly (*Plebejulina emigdionis*) is very rare and the genus is monotypic. This species is restricted to about 12 locations in Kern, Inyo, San Bernardino, and Ventura counties. On NAWS-CL it has an expansive territory south and southeast of El Conejo Gate and in Big Petroglyph Canyon. The species often occupies small areas of one to five acres (0.4–2 hectares) of habitat, which also seems to be the case at NAWS-CL. Their larvas are associated with a specific ant, Formica

pilicomis and they use fourwing saltbush (*Atriplex canescens*) as a larval host and as a specific food plant. This species of butterfly is very closely linked to this symbiotic relationship.

Square-spotted blue butterflies (*Euphilotes baueri vernalis*) may be one of the most unique butterflies on NAWS-CL. The only area outside of NAWS-CL where this butterfly is known to occur is Coxey Meadow in the San Bernardino Mountains in an area less than a few square miles. It may occur south of Butterbredt Peak on the southeastern slopes of the Sierra Nevada. On NAWS-CL it has been found on the eastern side of Louisiana Butte and north into the Coso Mountains near Pinon Bridge. It is also present in the mountains west of Etcheron Valley. It is found wherever its host plant Kennedy's buckwheat (*Eriogonum kennedyi*) is found.

The Great Basin wood-nymph (*Cercyonis sthenele*) may compete with feral horses and burros because its host species are perennial grasses of unknown species (Pratt and Pierce 1995). The number of individuals of this species was very low during 1994, which may be due to natural causes, such as low precipitation, or may be due to a combination of factors which includes competition with horses for grasses during a dry year. There was very little grass in open areas where Great Basin wood-nymphs occurred that had not been closely cropped by feral animals, probably horses (Pratt, pers. com.). Pratt (1995) found Great Basin wood-nymphs in Shepherd Canyon, high elevations of the Argus and Coso mountains, and in the northern mountains of the western side of Etcheron Valley. The Great Basin wood-nymph was probably more widespread in the past and in the 1930s was abundant in Mountain Springs Canyon. No Great Basin wood-nymphs have been found there by Pratt.

Constraints to NAWS-CL activities due to the presence of sensitive butterflies are expected to be minimal or low depending on the species of butterfly. The pallid dotted-blue butterfly (*Euphilotes pallescens*) and arachne checkerspot (*Poladryas arachne*) are near target sites in the Coso Mountains. As long as the target sites are not enlarged into butterfly habitat, impacts to butterflies should be minimal. The San Emigido blue butterfly is found along the road near El Conejo Gate. This butterfly could be impacted if the road was widened or during the flight periods of the butterfly. In the latter case, butterflies could be killed by vehicles. However, vehicular use on the road is generally low, minimizing the potential impact to the species.

Table J-2 lists butterfly food plants, the potential number of butterfly species associated with each plant, and the number of butterfly species on NAWS-CL associated with each plant.

Table J-2. Butterfly food plants, potential species associated with each, and the number of butterfly species on Naval Air Weapons Station China Lake associated with each plant.

Food Plant	Number of Butterflies	
	Potential	On NAWS-CL
Arabis perennans	3	2
Arceuthobium divaricatum	1	1
Artemesia dracunculus	1	0
Asclepias erosa	2	2
Astragalus lentiginosus	3	3
Atriplex cannescens	4	4
Bebbia juncea	1	1
Cassia armata	2	2
Castelleja chromosa	1	1
Caulanthus cooperi	1	1
Caulanthus lasciophyllus	1	1
Ceanothus greggii	2	0
Chenopodium califomica	1	0
Chrysothamnus viscidiflorus	1	1

Food Plant	Number of Butterflies	
	Potential	On NAWS-CL
Cirsium mohavense	2	1
Cowania mexicana	1	1
Cymopterus panamintensis	1	0
Distichlis spicata	2	0
*Erigeron breweri**	1	0
Eriogonum baileyi	1	1
Eriogonum fasciculatum	1	1
Eriogonum heermanii	3	2
Eriogonum inflatum	1	1
Eriogonum kennedyi	1	1
Eriogonum nudum	1	1
Eriogonum pusillum	1	1
Eriogonum umbellatum (2 var.*)*	3	3
Eriogonum wrightii	1	0
Fraxinus anomala1	1	0
Gnaphalium chilense	1	0
Juniperus osteospermum	1	1
Lotus procumbens	1	1
Lupinus argenteus1	1	1
Oxytheca perfoliata	1	1
*Palafoxia linearis**	1	1
Penstemon speciosus	1	1
Phoradendron bolleanum1	1	0
Phragmites australis	1	1
Pinus monophylla	1	0
Prosopis glandulosa	2	0
Prunus andersonii1	1	1
Purshia glandulosa	1	1
Ribes cereum	1	1
Ribes velutinum	1	1
Rumex salicijolius1	1	0
Salix laevigata	2	1
Salix lasiolepis	1	1
Sphaeralcea ambigua	4	3
Stanleya pinnata	2	2
Thamnosa montana	1	1
Urtica dioica ssp. *holosericea*	3	3
Viola purpurea1	1	0
Xylorhyza tortifolia	1	1
Yucca brevifolia	1	1
Total	78	56

* Recorded on NAWS-CL but not observed by Pratt and Pierce during recent survey efforts.
1 Found on NAWS-CL but not on list.

J.2.2 Amphibians and Reptiles

Frogs and Toads. Western toads (*Anaxyrus boreas*) and Pacific Treefrogs (*Pseudacris regilla*) live and breed near temporary and permanent ponds, pools, and streams throughout the southwest. They may be found crossing roads on rainy nights, but low amounts of rainfall may have reduced their visibility. The western toad is found throughout urban areas of China Lake, Ridgecrest, and Inyokern. On NAWS-CL ranges western toads are

confirmed at Haiwee Spring (Giuliani 1993; Michael Brandman Associates Inc. 1988). The Pacific Treefrog is known on NAWS-CL from one record at Haiwee Spring (19 September 1980) but is also known from the southern Argus Range (Indian Joe Canyon) off the station (Woodman, pers. obs.). The breeding habitat for frogs and toads on NAWS-CL is limited to areas of persistent standing water or areas that are ephemerally inundated. Generally speaking, upland habitat is restricted to areas closely associated with breeding habitats. Neither of these species has any special status constraints to activities on NAWS-CL due to the presence of western toads and Pacific Treefrogs are expected to be minimal.

Chuckwalla. The Chuckwalla (*Sauromalus ater*) is accounted for by the California Natural Diversity Database, but is not a species that warrants state level status (Jennings and Hayes 1994). Although present, the distribution of Chuckwalla at NAWS-CL is unknown; they could potentially occur in all rocky areas of the Argus and Coso Mountains from sea level to 6,000 feet (1,829 m) and throughout rocky habitats on the South Range.

Panamint Alligator Lizard. The Panamint Alligator Lizard (*Elgaria panamintina*) is a California Species of Concern, as well as a BLM Sensitive Species. Panamint Alligator Lizards have a known distribution limited to between 2,500 and 6,800 feet (762–2,073 m) AMSL in Inyo and Mono Counties in the White, Nelson, Inyo, Panamint, Coso, and Argus Mountains (Jennings and Hayes 1994; Michael Brandman Associates Inc. 1988). They are restricted to riparian areas with available open water, although they may utilize adjacent upland habitat. Potential Panamint Alligator Lizard habitat on NAWS-CL is restricted to the Argus and Coso Ranges in the northern and northeastern North Range within the vicinity of permanent springs or riparian habitat.

Five Panamint Alligator Lizards have been confirmed from NAWS-CL. Phillips, Brandt, and Reddick Inc. (1983) reported a juvenile at Margaret Ann Spring, Giuliani (1993) recorded one at Haiwee Spring, Silverman (2001) captured two juveniles in Mountain Springs Canyon, and Bruce Garlinger (2001) observed one adult basking on a feral horse trail in Mountain Springs Canyon. Giuliani reported that Coso Cold Spring contained good habitat for the species. In 1988, several suspect and unconfirmed sightings of the lizard were reported.

Gilbert's Skink. Gilbert's Skink (*Plestiodon gilberti*) was previously considered a BLM-sensitive species that may be used as an indicator species of habitat quality (BLM 1980). It is widespread among springs and riparian habitat on the NAWS-CL North Range. A graduate student from Cornell University has conducted surveys for skinks, primarily from around Birchum Springs.

J.2.2.1 Other Herptofauna Considered

Slender Salamander. Slender Salamanders (*Batrachoseps* spp.) have not been found on NAWS-CL. However, it is assumed that they are present because they are in surrounding mountain ranges, including the Panamint, Inyo, and Sierra Nevada ranges. Slender Salamanders are difficult to locate and are active only during a short period of the year. If they are present on NAWS-CL, the possibility exists that they could be a new species.

Giuliani (1993) noted that there was the probability of Slender Salamanders occurring at Upper Haiwee Springs. Michael Brandman Associates, Inc. (1988) reported potential habitat at Haiwee Springs, Mountain Springs Canyon, and Coso Cold Springs with the best potential habitat at Margaret Ann Springs, but indicated the potential for them occurring at NAWS-CL was low.

Slender Salamanders are typically found on moist talus slopes or cliffs rather than in open water. They probably breed and lay eggs in moist subterranean situations. This makes them especially susceptible to impacts from large grazing ungulates that may utilize these slopes to access riparian and upland vegetation and open water.

Potential threats to this species are due to degradation of habitat by large feral ungulates.

Constraints to NAWS-CL activities due to the presence of Slender Salamanders are expected to be minimal due to their restrictive habitat requirements and because they are found only at springs, seeps, or riparian areas, habitat types with great value to a variety of sensitive species and already protected.

J.2.3 Birds

Wetland and Water Dependent Bird Species. There are several types of water sources available on NAWS-CL, including: natural perennial waters, such as springs and seeps, which support natural riparian vegetation; natural ephemeral water, such as lake beds (playas), tenajas, and washes; and man-made waters, such as the evaporation/percolation ponds located at the Wastewater Treatment Facility and Lark Seep/G-l Seep system. Each water type has specific taxa associated with it.

Open water is a scarce commodity in the desert. During migration, especially over desert areas, open water is a crucial resource for resting and foraging. Because birds use traditional flyways, they are often dependent on known water sources. When wet, playas can provide foraging opportunities for shorebirds as water triggers the hatch of invertebrate eggs. Some species are dependent on water sources for nesting and/or foraging. These resources may be especially crucial in preventing further decline of populations for bird species listed or proposed for listing.

Natural Perennial Waters. Numbers and locations of springs and seeps are discussed in Section 3.3.4.2 of the INRMP. Many NAWS-CL are associated with springs, seeps, and adjacent riparian vegetation. Although birds utilize open water, those found in natural perennial waters are primarily dependent on the riparian habitat associated with the springs and seeps. However, the riparian vegetation is dependent on a reliable surface or subsurface water supply. Water systems at many springs are not well understood. Prior to diversion of water, tests should be conducted to identify the source and mechanics of the hydrology. The ten NAWS-CL Special Status Species birds associated with riparian habitats are discussed in Section 3.5.6.2 of the INRMP.

Natural Ephemeral Waters. Playas provide habitat for a number of species. Species such as fairy shrimp have evolved so that their eggs persist during dry periods. When a playa is inundated with water, eggs hatch, and fairy shrimp become active. Shrimp provide food for birds and other wildlife that are able to utilize this intermittent food supply. When wet, playas provide water for migrating birds, they enhance their chances for successful migration. Birds most likely to use this resource are shorebirds.

Desert washes are also intermittently wet. Although surface water may not be present, there may be subsurface flow which increases vegetation that is typically representative of Mojave Desert Wash Scrub plant communities (Holland 1986). Vegetation in washes is typically lusher with higher diversity and density of plants and animals (Brown 1982). This provides greater protection and feeding opportunities for resident and transient birds.

Man-Made Waters. Many NAWS-CL birds can only be found at NAWS-CL during migration or under unusual circumstances. Only the western least bittern (*Ixybrochus exilis hesperus*), northern harrier (*Circus cyaneus*), and western snowy plover (*Charadrius alexandrinus nivosus*) are known to nest near NAWS-CL (Owen's Lake and/or Harper Lake) and could nest at NAWS-CL. The coastal population of the western snowy plover is federally-listed as threatened, and color-banded coastal birds can range widely as they have been observed in the Central Valley and potentially to NAWS-CL. The population of western snowy plovers which nests near NAWS-CL is presumably the unlisted inland population. The inland population is a California species of special concern. Western snowy plovers are uncommon migrants and extremely rare summer residents on NAWS-CL. Juvenile (flying) snowy plovers have been observed at the Waste Water Treatment Facility, but their range is unknown (Blue, pers. com.). Flightless juveniles or nests have not been observed. No coastal plovers have been observed at NAWS-CL.

Raptors and Owls. Cooper's hawks (*Accipiter cooperii*) breed in pinyon pines. Golden eagles (*Aquila chrysaetos*) and prairie falcons (*Falco mexicanus*) breed on cliffs in a variety of plant communities. Burrowing owls (*Athene cunicularia*) breed in in lower elevation desert habitats. Sharp-shinned hawks (*Accipiter striatus*) are a common winter resident in urban areas and may breed in the pinyon pines on the North Range although this has not been documented (Michael Brandman Associates 1989). Long-eared owls (*Asio otus*) are a fairly common winter resident and transient. They have been recently documented nesting on the nearby Cerro Community College campus. Eight raptor and one owl species are transients that are rare or extremely rare on NAWS-CL.

Six raptors and one species of owl are typically found in wetlands and riparian areas. Of these species only northern harriers are common residents, though they apparently do not breed. The other five species are rare to extremely rare migrants. There appear to be no current threats to these species posed by activities at NAWS-CL.

Three species most likely impacted by activities at NAWS-CL are the golden eagle, prairie falcon, and burrowing owl. All are uncommon residents. Michael Brandman Associates (1989) found eight golden eagle and 20 prairie falcon breeding territories on NAWS-CL in 1987 and 1988. Golden eagles and prairie falcons require rock cliffs for nest sites and adjacent habitat for foraging.

Burrowing owls nest throughout desert areas of NAWS-CL and are probably most common around the golf course. There are fewer than 100 pairs on NAWS-CL (Michael Brandman Associates 1989). The availability of nest and roost sites in the form of Mohave Desert Tortoise (*Gopherus agassizii*), American badger (*Taxidea taxus*), coyote (*Canis latrans*), and kit fox (*Vulpes macrotis*) dens or burrows appears to be the principal limiting factor in their distribution and abundance. By virtue of their ground-nesting habits, burrowing owls are vulnerable to human-related disturbance.

A potential impact to raptors, primarily golden eagles but also buteos, are powerline electrocutions. Raptors use power line support structures primarily for hunting perches but also for nesting. Some power poles are preferred by eagles because they provide considerable elevation and a wide range of vision, easy takeoff, and greater attack speed when hunting. Seeking preferred poles facilitates the resolution of some electrocution problems, but in homogeneous habitats one pole would not provide an advantage over another to a hunting eagle; therefore, corrective measures must be applied more widely (Olendorrf et al. 1981).

Most lines that electrocute raptors are smaller distribution lines or individual service lines. Higher voltage lines tend to have wider wire spacing, making it impossible for birds to contact two wires at the same time. Adequate separation of energized wires, ground wires, and other metal hardware is the most important factor in preventing raptor electrocution. The objective is a 60-inch minimum separation of conductors (Olendorrf et al. 1981). Because of vast diversity of line designs and voltage used, generic recommendations cannot be made. However, specific problems can be addressed through design and modification of poles, crossarms, and wire placement which effects adequate separation of energized hardware. Insulation of wires and other hardware where sufficient separation cannot be achieved is also possible.

J.2.4 Mammals

Bats. Bats require roost sites to spend the day, for maternal sites, and for winter hibernation. Depending on the species, roost sites (and roost uses for one species) may have different requirements, but all typically need good air-flow and lack of disturbance. Bats require open water over which they skim to drink. Some species have communal roosts and tend to use mines, old buildings, or caverns, whereas other species tend to roost in areas with a few individuals or solitarily, tending to use cracks or crevices in rocks or tree hollows.

Pallid Bats. Pallid bats (*Antrozous pallidus*) are California-listed as species of special concern. Pallid bats are found throughout the southwestern United States. On NAWS-CL they are known from a number of sites in the Coso Mountains. Pallid bats are large, long-eared vespertilionids with big eyes, a pig-like snout, and a distinctive skunk-like odor. Maternity colonies form in spring (March-May) and stay together until October (Barbour and Davis 1969). Roosts may be in old, new, or occupied buildings, mine tunnels, crevices in cliffs, undersides of bridges, elevator shafts, or many other shelters. Disturbance to the roost may cause them to abandon it. Most colonies number between 25 and 125 individuals. Males may leave the colony prior to partuition; thus, leaving a maternity colony. Breeding occurs in fall, and delayed fertilization occurs in spring. One or two young (usually two) are born primarily in June. Maternity colonies generally break up within two months after partuition. Pallid bats commonly feed on prey captured on the ground. Evidence of breeding or hibernating colonies of pallid bats has not been found on NAWS-CL, although juveniles have been netted at Granite Wells and Birchum Spring. There are no winter records of this species on NAWS-CL. Pallid bats forage on or near the ground on large arthropods, including scorpions, solpugids, beetles, grasshoppers, cicadas, katydids, and sphinx moths. Populations of pallid bats have been noted as declining in recent years in most of California. The primary threats to pallid bats are loss or disturbance to roosts and destruction of foraging habitat.

Townsend's Big-Eared Bats. Townsend's big-eared bats (*Corynorhinus townsendii*) are California-listed as species of special concern and proposed for threatened. Townsend's big-eared bats are found throughout the western United States (Idaho State Conservation Effort 1995). On NAWS-CL they are known from a number of mines and maternal roosts, including Redwing Mine, Star of the West Mine, and Josephine Mines (Brown-Berry 1993). An estimated over 200 female Townsend's big-eared bats were roosting inside the upper shaft of Redwing Mine in spring 1992. However, in August 1993 only about 30 were observed leaving the mine. Dr. Brown-Berry believed human intrusion was the cause of the abandonment as the mine had evidence of human activity (Brown-Berry 1994). At the Star of the West Mine more than 40 dead juveniles had apparently starved after their mothers were driven from the mine in August 1989. The mine had been used for seismic monitoring, and Dr. Brown-Berry believed repeated visits were the cause of abandonment. Townsend's big-eared bats are medium-sized with buffy brown fur distinguished by the combination of two horseshoe-shaped lumps on the rostrum, and large, rabbit-like ears (Barbour and Davis 1969; Kunz and Martin 1982). Pierson (1998) summarized the natural history requirements of this species. Big-eared bats form maternity colonies in spring varying in size from a dozen to several hundred animals.

Breeding takes place in fall and winter and ovulation in early spring. Birth of a single young occurs in June. Young grow rapidly, and most are able to fly by mid to late July (Hoffmeister 1986). This species is a lepidopteran specialist, feeding primarily on medium sized moths (Dalton et al. 1986; Ross 1967; Sample and Whitmore 1993; Whitaker et al. 1977, 1981; Shoemaker and Lacki 1993). Townsend's big-eared bats are known to hibernate on NAWS-CL.

Fairly strong air flow is required for roosts and hibernacula; thus, at least two entrances are needed. Population declines have been recorded for this subspecies in many areas of California (Pierson and Rainey 1996). The primary threat to Townsend's big-eared bats is directly linked to human activity. Intolerance to roost disturbance or destruction, the tendency to roost in highly visible clusters on open surfaces near roost entrances, and low reproductive potential and high roost fidelity increase the risks for this species.

Spotted Bats. Spotted bats (*Euderma maculatum*) are widely scattered throughout the southwestern United States. A spotted bat was detected by Dr. Pat Brown-Berry over Coso Cold Springs in August 1993 and one roosted at NAWS-CL mainsite (Tom Campbell, pers. com.). No roosts have been found on NAWS-CL, nor has there been evidence of breeding. Spotted bats require rocks and cliffs for roosting, but little is known of their natural history (Hoffmeister 1986).

Western Mastiff Bats. Western mastiff bats (*Eumops perotis*) are found throughout the southwestern United States. On NAWS-CL they have been detected emerging from a canyon in the lava flows about two miles east of Coso Hot Springs (Zembal et al. 1978). Brown-Berry (1993) heard a western mastiff bat at Coso Cold Spring in June 1993. Western mastiff bats are the largest member of their order with a wingspread of almost two feet. These fast, wide-ranging bats hunt for flying insects as high as 1,000 feet (305 m) above the ground. Day roosts are typically in rock crevices in high, vertical cliffs. Colonies are almost always less than 100 animals. Krutzch (1955) states that many diurnal roosts may be occupied infrequently or temporarily. Pregnant females can be found any time from April until mid-June. Usually a single young is produced. Juveniles less than a week old are known from June 16 to August 10. No evidence of breeding or wintering has been observed on NAWS-CL.

Threats to bats on NAWS-CL are generally from intrusion of roost sites and degradation of water sources. Mines supporting two important maternity colonies of Townsend's big-eared bat (Redwing and Star of the West) have been sites for seismic monitoring or other studies, and repeated intrusion has reduced the number of animals. Numbers of Townsend's big-eared bats have steadily declined at the Redwing Mine over the past 15 years, and the abandonment of the Star of the West Mine was discussed above.

Constraints to NAWS-CL activities due to the presence of bats are expected to be minimal as roosts tend to be in inactive mines that are generally not used by NAWS-CL. Greater communication with EPO should be conducted prior to use of mines for any testing purposes. Mines that are bat roost sites should not be used for NAWS-CL activities. Since abandon mines are numerous, access to and use of suitable mines not supporting roost sites should not be difficult.

Nelson's Bighorn Sheep. Nelson's bighorn sheep (*Ovis canadensis nelsoni*) are found in desert mountain range and are one of three races of bighorn sheep inhabiting California. Surveys by Weaver and Mensch (1970) led them to conclude that bighorn populations were transient in the Coso Mountains. They estimated the Argus Mountains and Eagle Crags populations to be 12 and seven respectively. Weaver (1982) reported that sheep had disappeared from the Coso Mountains sometime after 1948 and from the Argus Mountains and Eagle Crags sometime after 1971.

The status of re-introductions was uncertain as of 1991. There was evidence of bighorn sheep in both areas and evidence of reproduction in the Eagle Crags. Financial constraints have hindered attempts to survey bighorn populations on NAWS-CL. There was concern that disease had been introduced to the Eagle Crags population during the 1987 re-introduction. Bighorn sheep (adults and young) were observed in 1995 and fresh scat collected at Lead Pipe Spring in the Eagle Crags in 1997. Current herd size and health is unknown. A survey completed in 2011 recorded approximately 20 sheep in the Eagle Crags area (T. Campbell, pers. com.).

Argus Mountains Kangaroo Rat. The Argus Mountains kangaroo rat (*Dipodomys panamintinus argusensis*) is a BLM-sensitive species having limited distribution. On NAWS-CL it is known from Upper Cactus Flat to Darwin Wash and south to Wild Horse Mesa and Wilson Canyon. Except for populations north of NAWS-CL and on eastern slopes of the Argus Mountains, its entire range is on NAWS-CL. Threats to Argus Mountains kangaroo rats on NAWS-CL are habitat loss and degradation. Constraints to NAWS-CL activities due to the presence of this species are expected to be minimal due to few facilities within their known distribution.

Vole (unknown species). The voles captured on NAWS-CL have not been positively identified but are thought to be California voles (*Microtus californicus*). California voles are known from grasslands throughout western and central California, from Mono Lake through Owen's Valley and from Amargosa and Mojave River drainages. Four subspecies of California voles are California Species of Concern and one is state listed, and federally listed; the endangered Amargosa vole (*M. c. scirpensis*), found less than 50 miles (80 km) to the east of NAWS-CL. The

Owens Valley vole (*M. c. vallicola*) and Mojave River vole (*M. c. mohavensis*), found north and south of NAWS-CL, are California Species of Concern. The genetic relationship of voles found at NAWS-CL to other populations north and south of the Station is unknown.

On NAWS-CL voles were captured at Lark Seep, Paxton Ranch, and Margaret Ann Spring (Kiva Biological Consulting 1993). They were captured in riparian habitat at Margaret Ann Spring and in saltgrass at Paxton Ranch and Lark Seep. Threats to the species are degradation or loss of riparian habitat due to feral horses and burros. Constraints to NAWS-CL activities due to the presence of voles are expected to be minimal due to their restricted distribution.

A single desert shrew was collected in a pitfall trap north of Coso Village in 1996. This specimen represents a major range extension for this species. It was not previously known from the Mojave Desert. This species has recently undergone major taxonomic revision, so efforts to trap and identify the population present on NAWS-CL should be made.

Ringtail. The ringtail (*Bassariscus astutus*) is a BLM-sensitive species. Ringtails generally inhabit brushy, rocky slopes between 3,500 and 7,000 feet (1,067–2,134 m) elevation. They are strictly nocturnal and seem to be active chiefly in the middle of the night. Dens may be in hollow trees, rock piles, or cliff crevices. Distribution and density on NAWS-CL are unknown, but they are thought to be widely scattered throughout the Argus and Coso mountains in riparian or brushy habitats adjacent to rocky slopes and in rocky areas of Mojave Pinyon Woodland. There does not appear to be an appropriate habitat on the South Range for ringtails. Ringtails have been observed by Leitner (1979) in the Coso Known Geothermal Resource Area and by Westec (1983) in Mountain Springs Canyon. Possible threats to the species are habitat loss or degradation in riparian areas. Constraints to NAWS-CL due to the presence of ringtails are expected to be minimal because the species uses habitat that is minimally used by NAWS-CL.

American Badger. The American badger is California-protected as a California Species of Special Concern and a BLM Sensitive Species. Badgers inhabit a variety of habitats from sea level to over 8,000 feet elevation from dry deserts to dense forests. They are primarily diurnal and typically dig out prey, usually rodents. On NAWS-CL they may be found on all but the steepest slopes of the North and South ranges. Threats to American badgers are habitat loss or degradation. Most NAWS-CL facilities and infrastructure occur on the bajadas and alluvial fans which are habitat for this species. Some protection is afforded this species from Mohave Desert Tortoise management efforts.

Mountain Lion. The mountain lion (*Felis concolor*) occurs in low numbers on NAWS-CL. It is found in a wide variety of habitats in virtually all mountainous areas of California. It feeds primarily on deer, but also preys on rodents, skunks, porcupines, and bighorn sheep. Two to three cubs are usually born during the spring in a den, typically a cave or crevice in a rock pile. Records of observations on NAWS-CL are from Burro Canyon, Etcheron Valley, Coso Peak, and tracks at PK Ranch.

On NAWS-CL, mountain lions are probably found throughout the Argus and Coso mountains but are uncommon. In winter, mountain lions will venture to lower elevations and may be seen in Creosote Bush Scrub. Possible threats to the species are loss or degradation of habitat or prey base.

Mohave Ground Squirrel. Due to the small geographic range of the Mohave ground squirrel (*Spermophilus mohavensis*) and loss of its habitat, it was designated rare by the State of California in 1971. This was changed to a designation of threatened in 1985 when the State of California amended their Endangered Species Act to match the federal nomenclature. The Mohave ground squirrel prefers alluvial-filled valleys with deep, fine to medium textured soils with Joshua Tree Woodland, Creosote Scrub, Shadscale Scrub, or Alkali Sink Scrub. Desert

pavement and eroded, shallow soils that promote rapid runoff seem to limit populations, and they generally avoid rocky or mountainous terrain and sterile playas. On NAWS-CL, the majority of Mohave ground squirrel habitat is on alluvial fans adjacent to hills and mountains, where the sandy soils tend to be deep. It occurs on Brown Mountain at the south end of the Slate Range, Pilot Knob Valley and Superior Valley on the South Range, and on the North Range, it occurs in the Coso geothermal area, and south and east throughout the Indian Wells and Salt Wells valleys (Navy 1997).

Kit Fox. Kit foxes (*Vulpes macrotis*) occur in low densities throughout NAWS-CL. The fox is generally found below 4,500 feet (1,372 m) AMSL in creosote bush habitats. Kangaroo rats are the fox's primary prey, although they have been known to eat a wide variety of rodents, birds, lizards, and insects. Kit foxes are largely nocturnal and remain in their burrows during the hottest parts of the day. In addition to providing shelter for the foxes themselves, kit fox burrows also provide refugia for burrowing owls, lizards, and even the occasional desert tortoise. Kit foxes are primarily threatened by increasing development and fragmentation of their habitat. A leading cause of kit fox mortality is vehicle collisions.

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Appendix K: Soil Descriptions

Table K-1. Selected soil characteristics.[1]

ID Number	STATSGO Name and Location	Acreage at NAWS-CL	Percent Area of NAWS-CL
Undefined	Unclassifed soil characteristics	851	0.08
CA339	Rosamond, Rosamond Variant, Playas. Found on basin floors and playas in the North and South Ranges.	101,420	9.15
CA635	Cajon, Wasco, Rosamond. Found on alluvial plains in the North Range.	111,901	10.09
CA738	Mexispring, Rock Outcrop, Ferroburro. Found associated with granitic outcrops in the North Range.	130,753	11.79
CA739	Upspring, Blacktop, Rock Outcrop. Found on the northeast side of Rose Valley.	5,596	0.50
CA740	Arizo, Yellowrock, Riverwash. Found in Darwin Wash on the North Range.	14,606	1.32
CA742	Bunkerhill, Salt Flats, Dune Land. Found in Panamint Valley near northern boundary of the South Range.	595	0.05
CA750	Theriot, Rock Outcrop, Uhaldi. Found in upland areas of both the North and South Ranges.	39,676	3.58
CA751	Rubble Land, Clanalpine Family, Bregar. Found only in Maturango Peak area of the North Range.	3,300	0.30
CA760	Cartago, Yermo, Tinemaha. Found in upland flats and low hills in the North Range, including Darwin Hills, west side of Rose Valley, and canyons northeast of Coso Hot Springs.	15,949	1.44
CA761	Ulymeyer, Rovana, Bairs. Found in Etcheron Valley and Upper Cactus Flat on the North Range.	24,816	2.24
CA788	Blacktop, Downeyville, Rock Outcrop. Found along central granitic ridges of Coso Range in the North Range.	61,017	5.50
CA905	Rock Outcrop, St. Thomas, Tecopa. Found in small region near Goldstone Lake in the southeast corner of the South Range.	1,337	0.12
CA907	Rock Outcrop, Tecopa, Lithic Torriorthents. Found over most of Slate Range in the northern portion of the South Range.	62,256	5.62
CA909	Rock Outcrop, Upspring, Sparkhule. Found over most of the Tertiary volcanic peaks in the South Range.	163,478	14.75
CA910	Badland, Bitterwater, Cajon. Found on south margin of Straw Peak, north margin of Lava Mountains, and the southeast foothills of Panamint Range, all within the South Range.	17,759	1.60
CA913	Rock Outcrop, Lithic Torriorthents, Calvista. Found on the southwest slope of Argus Range and in Rose Valley on the North Range, and on the western slope of the Granite Mountains in the South Range.	23,477	2.12
CA919	Calvista, Rock Outcrop, Trigger. Found on the margins of Salt Wells Valley in the North Range and on the western margin of Superior Valley in the South Range.	68,649	6.19
CA930	Nickel, Arizo, Bitter. Found on the southeastern margin of Searles Valley and on scattered locations in the South Range.	31,826	2.87
CA931	Cajon, Arizo, Victorville Variant. Found on the South Range.	229,315	20.69
All	Sum of all soil classification acreages identified on NAWS-CL.	1,108,579	100

[1] Sources: STATSGO Database 1998; U.S. Natural Resources Conservation Services 1991; and Soil Conservation Service 1989.

Soil Series

The following soil descriptions are taken from: Natural Resources Conservation Science. 1998. State Soil Geographic (STATSGO) Naval Air Weapons Station, China Lake, California.

Arizo Soils

The Arizo series was established in Clark County, Nevada in 1971. Arizo soils form on recent alluvial fans, inset fans, fan aprons, fan skirts, stream terraces, and wash floodplains. Arizo soils are a sandy, mixed thermic Typic Torriorthenth with a gravelly, fine sand surface. They are neutral to strongly alkaline, often with thin lime coatings on the undersides of rock fragments. Arizo soils contain A, C1, and C2 horizons. Rock fragments make up 35–85% of the soil. Arizo soils occur between 750 and 4,600 feet (225–1,405 meters [m]) above mean sea level (AMSL) and form from mixed alluvium. Soils are excessively drained, with medium runoff and high to very high permeability. They generally support creosote bush (*Larrea tridentata*) scrub vegetation in southern Nevada, California, Arizona, and New Mexico.

Bairs

The Bairs soil series was proposed in 1987 in Inyo County, California from Benton-Owens Valley Soil Survey. The soil consists of well drained material formed in granitic alluvium and can be found on bouldery or stony alluvial fans and fan terraces. The Bairs series consists of five soil horizons: A1, A2, Bt1, Bt2, and C. This series occurs at elevations between 5,100 and 6,500 feet (1,554–1,981 m) with slopes that vary between 5 and 30%. The mean annual precipitation is 6–10 inches (15–25 centimeters) and much occurs as snow. The soils usually only produce slow to medium runoff and permeability is moderate to over rapid. The series is of small extent and occurs within east-central California. Bairs is primarily used for rangeland and recreation as well as wildlife habitat. Vegetation generally consists of desert bitterbrush (*Purshia tridentata* var. *glandulosa*), big sagebrush (*Artemisia tridentata*), ephedra (*Ephedra* sp.), and desert needlegrass (*Achnatherum speciosum*).

Bitter Soils

The Bitter series was first described for portions of San Bernardino and Inyo Counties, California, in 1979. Bitter soils are deep, well drained soils that form from weathered granite with some metamorphic and carbonate bedrock. Bitter soils form on dissected fan terraces with a slope between 2 and 20%. Bitter soils contain A1, A2, Bt1, Bt2, C1, and 2C2k horizons. Bitter soils occur between 2,500 and 3,600 feet AMSL. They have medium runoff and moderately low permeability. These soils support creosote bush or Joshua Tree (*Yucca brevifolia*) Woodland vegetation.

Bitterwater Soils

The Bitterwater series was first described in the foothills of northwestern Kern County, California in 1982. Bitterwater soils are deep, well drained soils that form from sandstone. They occur on hills with slopes between 9 and 75%, at elevations of 600–2,000 feet AMSL. Bitterwater soils are coarse, mixed, calcareous, loamy Typic Torriorthents. They consist of A121, A122, C1, C2, and C3r horizons. Bitterwater soils are related to several shallower soils from the east side of the southern Central Valley. Soils have very rapid runoff and moderately high permeability. Bitterwater soils support saltbush (*Atriplex* sp.) scrub and weedy annuals.

Blacktop

This Blacktop series was established in Inyo County, California in the Saline Valley Area in 1980. These soils can be found moderately extensively in the northern part of the California desert and southern Nevada. Blacktop consists of very shallow material derived from extrusive basic igneous rocks that drain somewhat excessively. The series is composed of only three horizons, A1, A2, and R, and is found on mesas, pediments, plateaus, hills,

and mountains. Blacktop elevation ranges from 4,200 to 6,500 feet and slopes are generally between 8 and 75%. The climate for this series is arid and the average annual precipitation is approximately 4–8 inches, which produces rapid runoff. Blacktop soils are mainly used for watershed, wildlife habitat, and recreation. The primary vegetation for this series is shadscale (*Atriplex confertifolia*).

Bregar

This series was established in Washoe County (Surprise Valley Home Camp Area), Nevada in 1974 and is found in northern Nevada, northeastern California, and southwestern Idaho. The soils are shallow to very shallow and are well drained materials derived from andesite, tuff, and quartzite. The horizons that Bregar is composed of include A1, A2, Bt, and R. The series is located on plateaus, hills and mountains. The elevation range is 5,000–8,000 feet and slopes have a wide range of 2–75%. Bregar typically occurs in semiarid climates with mean annual precipitation between 10 and 16 inches, which can result in high to very high surface runoff. These areas are used for rangeland as well as for wildlife habitat. The vegetation found on the Bregar series is mainly sagebrush, bluegrass (*Poa* sp.), and squirreltail (*Elymus* sp.).

Bunkerhill

The soils in the Bunkerhill series are formed in mixed lacustrine materials and are somewhat poorly drained. The series is found at relatively low elevations between 1,010 and 1,250 feet in flat areas with slopes usually only up to 2%. Bunkerhill was established in 1980 in Inyo County, California in the Saline Valley Area and is mapped in closed basins throughout the region to a moderate extent. The series occupies basin rims and consists of Az1, Az2, Bz, Bq, C1, 2Akb, and 2C horizons. The arid climate in which Bunkerhill occurs has an average annual precipitation between 4 and 5 inches. This type of land is used primarily for wildlife and recreation. The native vegetation is mainly pickleweed (*Salicornia* sp.).

Cajon Soils

The Cajon series was first described in 1917. Cajon soils are very deep, excessively drained soils that form from sandy alluvium from mostly granitic bedrock. They are common on alluvial fans, fan aprons, fan skirts, inset fans, and river terraces with slopes of 0–15%. This soil series is a mixed, thermic Typic Torripsamment with A, C1, C2, C3, C4, 2C5, 2C6, and 2C7 horizons. Cajon soils occur between 200 and 4,300 feet AMSL from the San Joaquin Valley, east to the Sonora Desert and southern Nevada. Related soils include Adelanto, Arizo, Calcio, Edalph, Goldivide, Gravesumit, Hesperia, Livefire, and Rosamond. Cajon series have negligible to low runoff and high permeability. Flooding is rare to never.

CalVista

The CalVista series was first described along the border of Los Angeles and San Bernardino counties in 1971. CalVista soils are shallow, well drained, and derived from granite rock with seams of calcite on mountain ridge slopes between 2 and 30%. CalVista soils consist of A1, A2, Bk, and R horizons with bedrock at depths of 14-20 inches. Gravel and coarse rock fragments are present but do not exceed 35% by volume of soil. The soil horizons are weakly expressed, with very little differences between the horizons. CalVista soils support creosote bush scrub and Mojave mixed woody scrub vegetation.

Cartago

The Cartago soil series was proposed in 1987 based in Inyo County, California in a Benton-Owens Valley Survey Report. The soils are of small extent and are found in Owens Valley in east-central California. The soils are very deep, somewhat excessively drained materials, derived from granitic and mixed alluvium. The Cartago series is composed of A, Cl, C2, and C3 soil horizons found on alluvial fans, fan terraces and the edges of valley floors;

found on slopes ranging from 0 to 30% at elevations between 3,700 and 5,500 feet. The mean annual precipitation varies, between 4 to 10 inches, and flooding phases are recognized in the Cartago soil series. Runoff is moderate to very low depending on the grade of slope; permeability is moderate to rapid to over rapid under certain conditions. Cartago areas are used for grazing, wildlife habitat, and as a source of materials for road construction. The typical vegetation consists of spiny hopsage (*Grayia spinosa*), Cooper goldenbush (*Ericameria cooperi* var. *cooperi*), ephedra, and needlegrass.

Clanalpine

The Clanalpine series consist of moderately deep soils derived from volcanic rocks. The soil is well drained and can have high to very high surface runoff. Clanalpine was established in 1985 in the southern part of Lander County, Nevada and is found moderately to extensively throughout central and western Nevada and adjacent California. The soil horizons that make up this series are A1, A2, Bt1, Bt2, Bt3, and Crt. Clanalpine is found on mountains at elevations between 6,500 and 9,000 feet and slopes range from 15 to 75%. The climate is considered semiarid and the mean annual precipitation is typically between 12 and 16 inches. Clanalpine is used for wildlife habitat and is commonly forestland. The vegetation is primarily singleleaf pinyon (*Pinus monophylla* var. *monophylla*) trees with an understory composed of fescue (*Festuca* sp.) and sagebrush.

Downeyville

Downeyville soil series was established in Esmeralda County Area, Nevada in 1984 and is primarily located in western Nevada with an extensive 300,000 acres of the series mapped. Downeyville consists of shallow to very shallow, well drained soils. The materials are derived from volcanic rocks and are found on hills, mountains, rock pediments, plateaus, and mesas. The series occurs at approximately 4,500 to 7,800 feet, varying greatly in slope aspect from 4 to 75%. The mean annual precipitation is 4 to 8 inches, and the soil composition allows for very high runoff and moderate permeability. The Downeyville series is used for livestock grazing and wildlife habitat. The vegetation is mainly shadscale, big sagebrush, and perennial bunch grasses.

Ferroburro

The Ferroburro series was established in Inyo County, California in 1980 and is mapped in northern parts of the California desert with a limited distribution. The horizons that contribute to this soil classification are A1, A2, C, and Cr; the type location of this series is found near Death Valley Monument. The climate in which this series occurs is considered semiarid and has a mean precipitation of about 9 inches. The soils are shallow, well drained, and derived from granitic rock. Ferroburro series can be found on hills and mountains at slopes of 15 to 75% at elevations of 5,000 to 7,000 feet. The drainage of the soil can result in medium to rapid runoff with a moderately rapid permeability. Land use typical of this series is a combination of recreation, rangeland, and watershed as well as wildlife habitat. Among rather typical desert vegetation, such as sagebrush and perennial grasses, singleleaf pinyon trees also occur in this series, making Ferroburro somewhat unique.

Mexispring

The shallow to very shallow soils that the Mexispring series is composed of derived from granitic rocks that are somewhat excessively drained. The series was established in 1980 in Inyo County, California to a small extent within the hills and mountains of northern Californian deserts. The very cobbly sandy loam is typically found on slopes between 15 and 85% at elevations between 4,000 and 6,700 feet. Rapid runoff results from the soil material that consists of A1, A2, and Cr horizons. The climate of Mexispring series is arid with hot summers and cool winters in which the annual precipitation is merely 6 to 8 inches. This soil series is used for watershed purposes, recreation, and rangeland. The areas are usually composed of various native vegetation types utilized by various wildlife species.

Nickel Soils

The Nickel series is extensive in the southwest and was first described in Clark County, Nevada. Nickel soils consist of deep, well-drained soils that form in alluvium from mixed rock sources. Nickel soils are loamy, poorly developed, superactive, thermic Typic Haplocalcids. Nickel soils form on erosional fan remnants and alluvial flats on slopes between zero and 35% and elevations between 2,000 and 4,000 feet AMSL. They contain Bw1, Bw2, Bk1, and Bk2 horizons and support creosote bush scrub.

Rosamond

The Rosamond series was first described in Antelope Valley, California in 1922. Rosamond soils are deep, well drained, and form from weathered granitic alluvium on the lower margins of fans and playas with a zero to 2% slope, between 2,200 and 2,900 feet AMSL. They are fine, loamy, mixed, superactive, calcareous, thermic, Typic Torrifluvents and contain C1, C2, 2C3, 3C4, and 4C5 horizons. Rosamond soils are common in the Mojave Desert. They have medium runoff and moderate to moderately low permeability. Rosamond soils support saltbush scrub vegetation.

Rovana

The Rovana series was proposed in 1987 in Inyo County, California from the Benton-Owens Valley Soil Survey. The series is of little extent in east-central California and is found on alluvial fans, fan terraces, and valley floors. The soil consists of very deep, somewhat excessively drained material derived primarily of granitic alluvium with a volcanic ash component. The elevation range of Rovana is between 4,500 and 6,200 and the slope is typically between 0 and 15%. The mean annual precipitation is 6 to 12 inches which can result in rare summer flooding. The Rovana runoff is slow to medium and the soil has a generally rapid permeability. This soil series is used for grazing and recreation as well as wildlife habitat. The vegetation primarily consists of typical arid desert flora including big sagebrush, ephedra, and desert needlegrass.

St. Thomas Soils

The St. Thomas series was first described along the Colorado-Virgin River Valleys near Overton, Nevada. St. Thomas soils are very shallow, well drained soils that form from carbonate parent materials. These soils occur on hills and low mountain slopes between eight and 75% between 1,800 and 4,500 feet AMSL. St. Thomas soils are loamy, poorly formed, calcareous, thermic Lithic Torriorthents with A, Bk, and R horizons; runoff is medium to rapid and permeability is moderately high. St. Thomas soils support creosote bush with galleta grass (*Hilaria rigida*).

Sparkhule Soils

The Sparkhule series was first described in Apple Valley, California and is associated with the Mojave River. Sparkhule soils are shallow to rocky and form from volcanic (basalt, andecite, and dacite) and granitic parent material. They are loamy, mixed, superactive, thermic Lithic Haplargids that occur on hillsides with slopes between 5 to 50% at elevations between 2,300 and 4,500 feet AMSL. They contain A, Bt12, Bt2, Bt3, and R horizons. Sparkhule soils support Joshua Tree Woodland and Creosote Bush Scrub.

Tecopa Soils

Tecopa series was first described in Inyo County, California. Tecopa soils are very shallow and form from metamorphic bedrock; up to 75% of the soil's surface is covered with gravel and cobbles. Tecopa soils contain A12, C1, C2ca, and R horizons. Tecopa soils are loamy, poorly formed, mixed, superactive, calcareous thermic Lithic Torriorthents that form on low hills and mountain slopes between 1,500 and 5,000 feet AMSL. The depth

to bedrock is 2-10 inches. Tecopa soils are related to St. Thomas, Arizo, and Bitter soils, supporting Creosote Bush Scrub and Joshua Tree Woodland.

Theriot

The horizons of Theriot series are A, Bk, and R, consisting of shallow to very shallow well drained soils derived from limestone and dolomite. The Theriot series is found on mountains and hills as well as ridges and pediments with a slope ranging between 8 to 75%. The series was established in 1940 in Lincoln County, Nevada and the type location is also found within Lincoln County. Theriot can be found throughout southern Nevada and the bordering areas of Utah and California and is considered to be moderately extensive in its range. The composition of this series is moderately permeable and medium to high surface runoff can occur. The typical annual precipitation of a Theriot soil series is approximately 7 inches. The soils are often used for rangeland and wildlife habitat. Typical vegetation of this series is principally shadscale, spiny menodora (*Menodora spinescens*), ephedra, and perennial bunch grasses.

Tinemaha

The Tinemaha series is found at elevations between 4,000 and 5,400 feet on fan terraces with slopes ranging from 0 to 15%. The climate of this series is arid with a mean annual precipitation typically between 4 and 10 inches. These areas are subject to rare flooding and the permeability of the soil ranges from slow to overly rapid. The series was proposed in 1986, in the Benton-Owens Valley in Inyo County, California; it is named for the nearby Tinemaha Creek. The series is found in Southern Owens Valley of eastern California and is not very extensive. Tinemaha soils are very deep and well drained and are formed in alluvium from primarily granitic sources. The series is composed of the A1, A2, Bt1, Bt2, and C soil horizons. Tinemaha soils are used for wildlife habitat and rangeland, with vegetation of spiny hopsage, ephedra, goldenbush, buckwheat, and needlegrass.

Trigger Soils

The Trigger series was first described along the Mojave River and is very limited in extent. Trigger soils are shallow, well-drained soils that form from sedimentary rocks on uplands, with slopes between 5 and 50% between 2,400 and 3,800 feet AMSL. Soils are loamy, mixed, superactive, calcerous, thermic Lithic Torriothents with A1, A1, Bk, and R horizons. Trigger series soils are related to Cajon and Sparkhule soils, and limited to the Mojave Desert. Trigger soils have moderate to rapid runoff and moderately high permeability. Trigger soils support creosote bush vegetation.

Uhaldi

The Uhaldi series is moderately extensive and is most commonly found in western Nevada. The soils are moderately deep and well drained and they derived from tuffaceous sedimentary rocks. Uhaldi was established in Douglas County, Nevada in 1981. The horizons of this series include A1, A2, A3, Bt1, Bt2, Bt3, and Cr. Uhaldi soils occur on slopes between 4 and 50% on rock pediments, plateaus, and hills at elevations ranging between 5,500 and 6,500. The climate of this soil type is semiarid with cool winters and warm summers with a mean annual precipitation of 12 to 14 inches. The surface runoff can vary from medium to very high with moderately slow permeability. This series is used for livestock grazing and as wildlife habitat. Native vegetation includes mountain big sagebrush, antelope bitterbrush as well as occasional singleleaf pinyon trees.

Ulymeyer

The Ulymeyer series consists of very deep soils that are somewhat excessively drained. The material of Ulymeyer formed in granitic alluvium to a moderate extent throughout east of the Sierra Nevada mountains in eastern California. The series was proposed in 1987 in Inyo County, California from the Benton-Owens Valley Soil

Survey. Ulymeyer is composed of three soil horizons, A, C1, and C2 and occurs on alluvial fans and fan terraces. It usually occurs at slopes ranging from 5 to 15% at elevations between 4,800 and 6,400 feet. Ulymeyer occurs in arid climates with mean annual precipitation between 8 and 12 inches which produces only slow runoff given the rapid permeability of the soils. Ulymeyer areas are typically used for grazing and wildlife habitat. Vegetation found on this soil series is mainly big sagebrush and desert needlegrass.

Upspring Soils

The Upspring series was first described on plateaus, hills, and mountains in Saline Valley in Inyo County, California. Upspring soils are very shallow, excessively well drained soils that form from basalt and other igneous and pyroclastic rock. Upspring soils are loamy, poorly formed, mixed, calcareous, thermic Lithic Torriorthents with A1, A2, Bk, and R horizons. Soils form on slopes between 8 and 75% at elevations between 1,600 and 4,400 feet AMSL. Upspring soils form near lava flows in northern California where they are fairly extensive. Upspring soils support shadscale scrub vegetation.

Victorville Variant Series

Victorville soils were first identified off Stoddard Valley Road in 1978. They are deep, moderately well drained soils that form from mixed alluvium, primarily from granitic bedrock. They are coarse-loamy, mixed calcareous thermic Mollic Torrifluvents, and contain Ap1, A12, C1ca, C2, and C3 horizons. They form on low river terraces and flood plains with 0-2% slopes. Victorville soils have medium runoff and moderately high permeability. Victorville soils support meadow and riparian vegetation. Much of this soil type is currently used for agriculture.

Wasco Soils

The Wasco series was first described near Wasco in the Central Valley, California. The ROI does not contain related soils. Wasco soils are very deep, well drained soils that form in mixed alluvium derived from granitic bedrock and on recent alluvial fans and floodplains with slopes of 0-5% and between 225 and 3,700 feet AMSL. Wasco soils are coarse loamy, mixed, superactive, nonacid, thermic, Typic Torriorethents with Ap1, Ap2, C1, and C2 horizons. Wasco soils were historically considered Hesperia soils but today Wasco soils are divided into warm and cool phases. The cool phase occurs in the Mojave Desert. Wasco soils support saltbush vegetation.

Yellowrock

The moderately extensive distribution of Yellowrock series throughout the northern California Desert can be found on alluvial fans, floodplains, and fan terraces. The soils are somewhat excessively drained and the runoff is slow to very slow with primarily rapid permeability. This soil series was established in Inyo County, California in 1980 and consists primarily of very deep, sandy soils formed in alluvium from mixed sources. The horizons of Yellowrock are A, C1, 2C2, 3C3, and 4C4, and the soils are generally very strongly alkaline. The climate of this series is arid with an average annual precipitation between 4 and 6 inches. Yellowrock soil series is mainly used as recreational land in addition to wildlife habitat. The vegetation associated with Yellowrock is somewhat determined by the alkalinity of the soil; native plant assemblages vary from creosote and white sage (*Salvia apiana*) to shadscale and saltbush.

Yermo

The type location for the Yermo soils is located in San Bernadino County, California and this classification was established in 1978. The series consists of well drained soils that are on long and/or smooth alluvial fans as well as uplands. Slopes range between 0 to 50% and the series consists of mixed moderately coarse calcareous, gravelly, or cobbly alluvium. Yermo series are found in arid climates throughout older uplands and valley floors at elevations between 2,300 to 4,200 feet. The soil consists of A, C1, and C2 horizons, all of which are generally

slightly alkaline. The soil composition is rather permeable; however, it also allows for medium to rapid runoff. The series is used for wildlife habitat and supports fundamental desert vegetation including creosote bushes, Joshua trees, and white bursage (*Ambrosia dumosa*).

Non-Soil Series Mapping Units

Badland

This classification is used to represent land areas that are generally quite barren and covered with sporadic drainages. The unique topography that results from the irregularity of water paths varies from moderately to extremely steep. The elevation differences range between 10 and 200 meters in badlands, which are most common in semiarid and arid regions. The soil usually consists of soft material that is not stony. This allows for high potential for run-off and active erosion during wind and rain events.

Dune Land

Dune lands are comprised of soils that are generally easily influenced by wind. The topography consists primarily of ridges and troughs of sand and other loose materials that actively shift during powerful weather activity.

Playa

Clay playas are very poorly drained flats and closed basins found at elevations from 1,700-3,250 feet AMSL. Many playas are also high in soluble chemicals such as sodium and calcium because after dissolving and transporting to a lakebed by storms, most of the water evaporates, leaving salts on or near to the surface. Playa surfaces lack vegetation or contain only saltbush scrub and become unstable with the use of tracked vehicles. Playa soils have low permeability and medium runoff, and the erosion hazard is high when the soils are dry. Playas recover from damage to a certain extent after rain fills the lakebeds, but are nevertheless off-limits to military vehicles due to erodibility.

Riverwash

Riverwashes are land areas adjacent to defined riverbeds, influenced and reworked by rivers on a frequent basis. Soil components typically consist of a mix of sandy, silty, clayey, or gravelly sediment. The soil surface in riverwash areas is unstabilized and is flooded and washed over during elevated water events.

Rock Outcrop

There are many areas of NAWS-CL classified as rock outcrops. The land type is a general grouping of areas consisting of exposed bare bedrock, typically hard rather than soft, which is not lava flow or rock-lined pits. Some rock outcrops are too small to feasibly delineate on soil maps; however, they can be indicated with symbols if necessary. Nevertheless, some rock outcrops are actually quite large with only small patches of soil breaking up the generally uniform, rocky, landscape. Some rock outcrop mapping units are named according to the kind of rock from which they are composed.

Rubble Land

Land that contains a diverse mix of rock types including cobbles, stones, and boulders is classified as rubble land. This land type is often found at the base of mountains; and occasionally found on mountainsides. When found on mountainsides, it is typically the result of various sized rocks deposited by glaciation or periglacial processes.

Salt Flats

Typically the consequence of closed basins, salt flats can be found within a range of arid regions. They consist of undrained lands where the water table can be near the surface. The soil consists of surface deposits of salt, usually in crystalline form, overlying stratified sediment that is very strongly saline.

Sand Dunes

This type of dune consists of fine to medium sand that is typically high in quartz and low in clay-forming material; they can also contain calcium carbonate as well as gypsum. Weather that induces wind activity can drastically alter the soil materials in terms of makeup and topography, especially after periods of drought. These areas are often the source of natural air pollution during extreme weather events. The vegetation that occurs on Sand Dunes is directly influenced by areas that are local as well as distant that contribute to the material that is deposited on the sandy openings.

Shallow Bedrock

Lithic Torriorthenths are too rocky to be described as a soil series. Lithic Torriorthenths generally occur between rock outcrops in small, depressed areas on relatively stable hillsides with slopes between 15 and 50%. They are shallow to very shallow and are intricately intermingled with the rock outcrops. They range in texture from sandy loam to very gravelly sands. Permeability of the unit is high to very high. Runoff is moderate to rapid and the water erosion hazard is high.

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Appendix L: Plant Community Descriptions and Habitat Functions

Vegetation communities are based on a system developed for Naval Air Weapons Station China Lake (NAWS-CL) natural resources management. There are 18 different types of vegetation units. Classes are series-based with simplified names. Community descriptions are based on field data (a review of past documents and 1996-1997 Vegetation Map data) and are cross-referenced to the following published classification systems: Brown et al.1982; Holland 1986; Munz and Keck1968; and Sawyer and Keeler-Wolf 1995.

Pinyon Woodland

Pinyon Woodland at NAWS-CL is defined where pinyon pine (*Pinus monophylla*) grows in moderate to dense stands, usually above 6,500 feet (1,980 meters [m]) above mean sea level (AMSL) on north slopes, drainages, and peaks of the Coso and Argus Ranges. Argus Peak is unique at NAWS-CL, having an extensive stand of pinyon pine below 6,000 feet (1,830 m) AMSL on north slopes. Above 7,500 feet (2,290 m) AMSL, pinyon pine at NAWS-CL is usually dense and dominant regardless of geology or aspect. Big sagebrush (*Artemisia tridentata*), Mormon tea (*Ephedra viridis*), and bitterbrush (*Purshia* spp.) are the most frequent associates in Pinyon Woodland. Other tall shrubs or trees, including one-seeded juniper (*Juniperus osteosperma*), Joshua tree (*Yucca brevifolia*), serviceberry (*Amelanchier utahensis*), buckbrush (*Ceanothus greggii* subsp. *vestitus*), plateau gooseberry (*Ribes velutinum*), and horsebrush (*Tetradymia canescens*) are frequently associated with Pinyon Woodland. The juniper becomes more prominent on harsher sites, being better suited to drought.

Pinyon Woodland provides habitat and shelter for bighorn sheep (*Ovis canadensis*), mule deer (*Odocoileus hemionus*), pinyon jays (*Gymnorhinus cyanocephalus*), black-throated gray warblers (*Dendroica nigrescens*), and many other species that benefit from pinyon nuts and juniper berries. Old growth woodlands provide hollow tree cavities and logs for nesting birds and mammals. Pinyon Woodland is also important as watershed cover and supports hydrologic function, allowing water from snow and rain to remain longer stored in vegetation and on the slopes rather than run off into the basins below. Finally, pinyon nuts are culturally important to Native American tribes, who harvest them locally.

Great Basin Mixed Scrub

Great Basin Mixed Scrub at NAWS-CL is defined where bitterbrush is a co-dominant cover or a common associate with big sagebrush and Mormon tea, usually occurring on upper slopes and rocky areas from 5,000 to 8,000 feet (1,525–2,440 m) AMSL. At lower elevations Great Basin Mixed Scrub also occurs as a narrow band where the base of rocky hills provides adequate moisture for bitterbrush. This band is usually bounded by Blackbrush Scrub above and Sagebrush Scrub below. Other characteristic shrubs of Great Basin Mixed Scrub include Joshua tree, purple sage (*Salvia dorrii*), sticky-leaved rabbitbrush (*Chrysothamnus viscidiflorus* subsp. *puberulus*), rubber-leaved rabbitbrush (*Chrysothamnus nauseosus*), and four-winged saltbush (*Atriplex canescens*). Where aspect or soils permit, other shrub species characteristic of higher elevations in the Mojave Desert or the Sierra Nevada foothills are intermixed in Great Basin Mixed Scrub.

Sagebrush Scrub

Sagebrush Scrub at NAWS-CL is defined where big sagebrush is dominant or co-dominant with less conspicuous or smaller shrubs. This plant community usually occurs between 4,500 to 6,500 feet (1,370–1,980 m) AMSL at NAWS-CL. In sandy valleys, flats, and basins of corresponding elevation, big sagebrush often forms shrub monocultures. Such formations are widespread in Etcheron Valley and Coles Flat. Sagebrush Scrub often occurs as a sandy subset of Great Basin Mixed Scrub. In these areas it is often associated with Joshua trees. Where Joshua trees are dense, these areas are defined under the Joshua Tree Woodland plant community. Sagebrush Scrub is also the dominant plant community on high elevation basalt lava flows where it is frequently associated with Mormon tea. In these areas other shrubs infrequently occur. Purple sage and snakeweed (*Gutierrezia microcephala*) are sometimes common on basalt mesas in Sagebrush Scrub. Such mesas can be found in the central Argus Range, east of Birchum Springs, surrounding Water Canyon, and west of Junction Ranch.

Blackbrush Scrub

Blackbrush Scrub at NAWS-CL is defined where blackbrush (*Coleogyne ramosissima*) is dominant, often forming pure monocultures with distinct population edges. This occurs at NAWS-CL on both North and South Ranges at elevations ranging from 3,500 to 6,500 feet (1,070–1,980 m) AMSL. Extensive stands of Blackbrush Scrub occur in the central Argus Range near Moscow Spring, north of Birchum Springs, north and east of Junction Ranch, and east of Coles Spring on the North Range. On the South Range, Blackbrush Scrub is very dense and conspicuous on north slopes of Slocum Mountain and extending northward to the Pilot Knob area.

Blackbrush Scrub is often geologically restricted and appears to be closely associated with granitic and limestone formations. Aspect and geomorphology strongly affect boundaries of Blackbrush Scrub, though specific requirements vary between areas. At low elevations, Blackbrush Scrub is generally associated with stable rocky soils with a north aspect, while at higher elevations the habitat is associated with rocky hilltops with poor moisture. Though blackbrush occasionally occurs on basalt and other extrusive formations, it appears to sharply decline at boundaries of these formations, often giving way to Sagebrush Scrub. Other Mojaven shrubs occur within Blackbrush Scrub, though generally when it does not occur as a near monoculture. Joshua trees are frequently associated with Blackbrush Scrub. Great Basin Mixed Scrub, Desert Transition Scrub, Joshua Tree Woodland, and Mojave Mixed Scrub often contain a large percentage of blackbrush cover. These compositions are separated with difficulty from blackbrush-dominated formations defined as Blackbrush Scrub.

Blackbrush is in the rose family (Rosaceae). When in full leaf it roughly resembles antelope bitterbrush (*Purshia tridentata*), with which it may co-occur. One way of identifying many of these plants in the rose family is that they are commonly infested with webs of tent caterpillars (*Malacosoma* sp.). Studies on the defoliation process associated with these caterpillars indicate that they seldom inhabit the same bush for more than three years because there is a lowering of food quality with each successive year. After metamorphosis, the adults live only a few hours. During that time they mate and select a new plant on which to lay their eggs. As the food quality of one bush is degraded, they move to another. This allows recovery of the original plant on which the caterpillar fed.

In the Mojave, blackbrush is joined on upper slopes with coarse textures by the drought-deciduous shrub known as bladder sage (*Salazaria mexicana*). Antelope ground squirrels (*Ammospermophilus leucurus*) climb in these shrubs and extract the seeds (Schoenherr 1992).

Among the succulent plants in this community are various Mormon teas (*Ephedra* spp.). The seeds produced by Mormon teas are also important forage for ground squirrels. In the Mojave Desert, the most conspicuous succulent plants of Blackbrush Scrub are two similar yuccas: the banana yucca or Spanish bayonet (*Yucca baccata*) and the Mojave yucca (*Yucca schidigera*). Banana yucca occurs in the eastern Mojave, and Mojave yucca occurs on upper

bajadas and rocky slopes all over the Mojave. When yuccas bloom, a high stalk of large white flowers projects above the leaves. White flowers are commonly pollinated at night, and the relationship between the night-flying yucca moths (*Tegeticula* spp.) and yuccas is often used as an example of mutualistic symbiosis. Yucca moths have to pack pollen onto the stigma of yucca flowers to accomplish pollination. After the moth drills a small hole into the ovary of the flower where it lays its eggs, larvae develop inside the fruit. This is the only way that yuccas are pollinated, and this is the only place where yucca moths lay their eggs (Schoenherr 1992).

Joshua Tree Woodland

Joshua Tree Woodland is one of the least definitive of plant communities described at NAWS-CL. Some plant classification systems do not recognize plant communities based on Joshua trees. Joshua trees are not normally associated with any consistent group of cover species, and even where dense, they are rarely the dominant cover type. In NAWS-CL area Joshua trees can occur with Saltbush Scrub (Rose Valley and Superior Valley), Creosote Bush Scrub (northeastern and western Coso Mountains), Mojave Mixed Scrub (Grass Valley), Shadscale Scrub (Centennial Flat and Cactus Flat), Blackbrush Scrub (north of Birchum Springs and PK Ranch), Sagebrush Scrub (Etcheron Valley and Coles Flat), Great Basin Mixed Scrub (entire Coso and Argus ranges), and Pinyon Woodland (on fringes of some pinyon pine areas). Joshua trees at NAWS-CL may be most frequent in Desert Transition Scrub (throughout the North Range).

Despite classification ambiguities, Joshua trees are ecologically and culturally significant. In many ways they are the most prominent and characteristic of NAWS-CL flora. In addition, there are some plant classification systems that recognize Joshua tree communities. For these reasons, prominent stands of Joshua trees are recognized at NAWS-CL as a separate plant community. Joshua Tree Woodland at NAWS-CL is defined where Joshua trees grow in dense formations, as taller, multi-branched individuals. Joshua trees appear to be most concentrated at NAWS-CL from 4,000 to 7,000 feet (1,220–2,130 m) AMSL, usually with an understory of Sagebrush Scrub, Desert Transition Scrub, Mojave Mixed Scrub, or Blackbrush Scrub. These areas are often alluvial valleys, washes, bowls, typically upstream of major drainages, canyons, or basins. Significant stands of Joshua trees can be found on the North Range at upper Renegade Wash, southwestern Etcheron Valley, upper Mountain Springs Canyon, Lower Centennial Flat, and northeastern Cactus Flat. On the South Range, Joshua trees are widespread but mostly sparse and small. Areas northwest of Pilot Knob and around PK Ranch have dense stands associated with a complex shrub cover.

Desert Transition Scrub

On NAWS-CL lands, there are significantly large areas of shrub formations characteristic of the transition between Great Basin and Mojave deserts. These extensive ecotonal zones can often be found where canyons meet uplands, especially on the North Range. Desert Transition Scrub formations at NAWS-CL commonly occur between 4,000 and 6,500 feet (1,220–1,980 m) AMSL.

Linear-leaved goldenbush (*Ericameria linearfolia*) is the most characteristic shrub of Desert Transition Scrub. Cotton-thorn (*Tetradymia axillaris* var. *longispina*) and bush penstemons (*Penstemon incertus* and *P. excubitus*) are also characteristic of Desert Transition Scrub. Blackbrush is one of the most frequently associated species and is very characteristic of transition between Great Basin and Mojave deserts. Where dominant, blackbrush is depicted as Blackbrush Scrub. Mojavean shrubs are more frequently associated with Desert Transition Scrub than Great Basin types, including Joshua tree, Nevada joint-fir (*Ephedra nevadensis*), golden cholla (*Opuntia echinocarpa*), green rabbitbrush (*Ericameria teretifolia*), California buckwheat (*Eriogonum fasiculatum*), bladder sage, peachthorn (*Lycium cooperi*), and snakeweed. Great Basin shrubs that are characteristic and frequent in Desert Transition Scrub include bitterbrush, big sagebrush, Mormon tea, and sticky-leaved rabbitbrush.

Limestone areas in the northern Argus Range of appropriate elevation for Great Basin Mixed Scrub are transitional towards carbonate-adapted compositions of Mojave Mixed Scrub (see Mojave Mixed Scrub – Carbonate Zone). These areas probably best fit under Desert Transition Scrub. In these areas, Great Basin species such as big sagebrush and bitterbrush are replaced by black sagebrush (*Artemisia nova*) and cliffrose (*Purshia mexicana*). Their associates tend to be Mojavean shrubs.

Mojave Mixed Scrub

Mojave Mixed Scrub is defined by boundary transition zones rather than by a specific shrub cover. For NAWS-CL vegetation classification purposes, lower boundaries of Mojave Mixed Scrub are defined where upper zones of Creosote Bush Scrub transition into shrub compositions that are no longer clearly dominated by creosote bush or burrobush, usually on well-drained upper bajada slopes above 2,500 feet (760 m) AMSL and typified by an increase in shrub diversity. The upper end of Mojave Mixed Scrub usually ends at 4,500 to 5,500 feet (1,370–1,675 m) AMSL, where there is a mix of Mojavean shrubs with the lowest elevation forms of Great Basin plant communities. No plants characteristic of the Great Basin are commonly found within NAWS-CL definition of Mojave Mixed Scrub. In general, most Mojave Mixed Scrub areas at NAWS-CL are associated with rocky slopes. Mojave Mixed Scrub is the most widespread of NAWS-CL plant communities and is found wherever the appropriate elevations are present.

No plant classification system for the Mojave Desert has yet produced a detailed system for the formations and series that occur above the typical creosote bush-burrobush association (Creosote Bush Scrub). Mojave Mixed Scrub is an aggregate of minor shrub series which become prominent and diminish with minor topological and geological changes. Some prominent sections of this ecotonal plant community have been further classified. These are utilized for NAWS-CL vegetation classification where their defining species are clearly dominant. They include Desert Transition Scrub, Joshua Tree Woodland, Shadscale Scrub, Hop-Sage Scrub, Mojave Wash Scrub, and Mojave Sand Field. These plant communities are often inseparable from Mojave Mixed Scrub in areas where their characteristic species are not dominant.

Besides classified community types, there are numerous localized series dominated by other shrubs, including water jacket (*Lycium andersonii*), cheesebush (*Hymenoclea salsola*), Cooper's goldenbush (*Ericameria cooperi*), green rabbitbrush, horsebrush, chaff bush (*Amphipappus fremontii*), indigo bush (*Psorothamnus arborescens* var. *minutifolia*), spiny menodora (*Menodora spinescens*), California buckwheat, and bladder sage. Creosote bush is often a dominant cover type within some definitions of Mojave Mixed Scrub. Other shrub types frequently occur in Mojave Mixed Scrub that tend to be associates rather than dominants, including goldenhead (*Acamptopappus sphaerocephalus*), Nevada joint-fir, ratany (*Krameria erecta*), Mojave aster (*Xylorhiza tortifolia*), desert alyssum (*Lepidium fremontii*), turpentine bush (*Thamnosma montana*), snakeweed, winterfat (*Krascheninnikovia lanata*), wire lettuce (*Stephanomeria pauciflora*), golden cholla, and brittlebush (*Encelia actonii*).

The most common form of Mojave Mixed Scrub at NAWS-CL is usually associated with north-or east-facing rocky slopes including a co-dominant composition of creosote bush, Cooper's goldenbush, indigo bush, green rabbitbrush, cheesebush, bladder sage, Anderson thornbush, spiny hop-sage (*Grayia spinosa*), California buckwheat, Mojave aster, Nevada joint-fir, wire lettuce, and brittlebush.

Subtypes of Mojave Mixed Scrub

To some extent, geologically influenced compositions of Mojave Mixed Scrub can be separated. Some frequently seen compositions at NAWS-CL include plants of upper bajada alluvium, rocky slopes and cliffs, carbonate formations, cinder and talus, aeolian deposits, canyon bottoms, and outlying washes. Mojave Sand Field (aeolian

deposits) and Mojave Wash Scrub (outlying washes) are two community types which are treated separately and have been similarly classified by Holland (1986). Both communities are highly transitional to Creosote Bush Scrub.

Upper Bajada Alluvial Scrub Subtype

Upper bajada alluvial zones usually have the tallest and most diverse scrub formations of Mojave Mixed Scrub. They tend to be at the higher elevations of Mojave Mixed Scrub. Characteristic shrubs of this zone include turpentine bush, Cooper's goldenbush, horsebrush, peachthorn, spiny menodora, winterfat, cheesebush, bladder sage, and Anderson thornbush. Joshua trees, blackbrush, and hop-sage are frequent in this zone and, where common, define their own plant communities. In the Grass Valley and Slocum Mountain region of the South Range, needlegrass (*Achnatherum speciosum*) is a codominant cover species in this zone. This zone of Mojave Mixed Scrub has the highest diversity of annual species at NAWS-CL. Gray's fescue (*Vulpia microstachys*), an annual grass species, is very characteristic of this zone.

Rocky Slope and Cliff Scrub Subtype

Rocky zones and cliffs, especially north-facing slopes, are characterized by goldenbush (*Ericameria cuneata*), green rabbitbrush, starry bedstraw (*Galium stellatum*), bushy bedstraw (*G. matthewsii*), pungent brickellia (*Brickellia arguta*), California buckwheat, bush cryptantha (*Cryptantha racemosa*), wire lettuce, desert alyssum, bladder sage, desert aster, needlegrass, rock lotus (*Lotus rigidus*), rock cress, thistle (*Cirsium mohavense*), and ferns (*Cheilanthes* and *Pityrogramma*). Annuals in north-facing rocky zones are few due to limited soil space. Roundleaf phacelia (*Phacelia rotundifolia*), eucryptas (*Eucrypta* sp.), miner's lettuce, and pterostegia (*Pterostegia drymarioides*) are very characteristic of this habitat.

Warmer zones of steep rocky areas in Mojave Mixed Scrub, especially west and south aspects, may also include creosote bush, burrobush, chaffbush, cottontop cactus (*Echinocactus polycephalus*), Engelmann's hedgehog cactus (*Echinocereus engelmannii*), beavertail pricklypear (*Opuntia basilaris*), brittlebush (*Encelia farinosa*), reticulated goldeneye, sweetbush (*Bebbia juncea*), and pygmy cedar (*Peucephyllum schottii*). These areas are transitional towards the Creosote Bush Scrub plant community. Annual plants in this zone are more typical of the Creosote Bush Scrub. Due to the slope aspects and cool air drainage, this zone often includes species typical of the Colorado Desert.

Carbonate Adapted Scrub Subtype

Carbonate geology within Mojave Mixed Scrub can have very unique and characteristic species. Usually these are associated with limestone outcrops, but carbonate-adapted Mojave Mixed Scrub vegetation can also be found on dolomite, metamorphics, fault zones, travertine, caliche deposits, and ancient saline lakebeds and shorelines. Shadscale (*Atriplex confertifolia*) and creosote bush are the most characteristic shrubs in this zone. Blackbrush and hop-sage are also common. Unlike other geologic settings in Mojave Mixed Scrub, these four shrubs on carbonate slopes are rarely dominant enough to separate into their own plant communities. Other characteristic shrubs include desert alyssum, winterfat, spiny menodora, Heerman buckwheat (*Eriogonum heermannii*), Death Valley ephedra (*Ephedra funerea*), Anderson thornbush, Mojave aster, turpentine bush, reticulated goldeneye, brittlebush, prince's plume (*Stanleya pinnata*), and snakeweed. Cacti are often locally abundant on south- and west-facing carbonate slopes. Most of these shrubs also occur in a variety of geologic settings, besides carbonate formations.

More closely associated with the carbonate zones of Mojave Mixed Scrub are species such as bud-sage (*Artemisia spinescens*), red kochia (*Kochia americana*), Nevada forsellesia (*Forsellesia nevadensis*), bush penstemon, and butterflybush (*Buddleja utahensis*). While these species are highly characteristic of carbonate zones, they are rarely common enough to contribute significantly to the shrub cover. Higher elevations in the carbonate zones of

Mojave Mixed Scrub also include black sagebrush, cliffrose, little-leaf mahogany (*Cercocarpus intricatus*), and desert snowberry (*Symphroricarpos longiflorus*) (see Desert Transition Scrub).

Herbaceous perennials are probably the most highly adapted formation in carbonate zones of Mojave Mixed Scrub. Characteristic species at NAWS-CL include tall perityle (*Perityle megalocephala*), golden forget-me-not (*Cryptantha confertiflora*), evening primroses (*Camissonia walkeri* and *Oenothera caespitosa* subsp. *crinita*), Inyo blazing star (*Mentzelia inyoensis*), various locoweeds (*Astragalus mohavensis*, *A. newberryi*, and *A. panamintensis*), sandwort (*Arenaria kingii*), and cliff phacelia (*Phacelia perityloides*). Annual species are mostly typical of other zones in Mojave Mixed Scrub. Not much is known about annual species of NAWS-CL limestone areas.

Cinder and Talus Scrub Subtype

Cinder and talus zones within Mojave Mixed Scrub have very distinctive, highly adapted plant compositions. Much of the steep terrain at NAWS-CL is typical of this geology and plant community. Cinder formations in the Coso Range are the most unique of these zones. Geomorphology and chemical rock type are strong determining factors in specific localized plant compositions. Most cinder and talus zones have very limited shrub cover with vegetation usually clinging to the most stable portions of slopes. Usually shrubs that occur on cinder and talus are typical of the surrounding area. One shrub, which appears to be adapted to a variety of cinder and talus slopes at NAWS-CL, is the shining sandpaper plant (*Petalonyx nitidus*). Bladder sage, bush lupine, groundsel (*Senecio flaccidus*), and pygmy cedar are also frequent on loose slopes, though less adapted to cinder soils than sandpaper plant. Plants characteristic of wash zones are often able to colonize lower slopes of talus and cinder slopes, where extra moisture is likely present. Many unique plants are also found on cinder and talus at elevations above Mojave Mixed Scrub at NAWS-CL, including several rare or species of concern.

Herbaceous perennials and annuals are plant formations most characteristic of cinder and talus zones within Mojave Mixed Scrub. Most small plants adapted to loose slopes have deep tap roots. Shallow rooted plants, such as grasses, are usually sparse on cinder and talus slopes because soils are poorly developed. Herbaceous perennials characteristic of these slopes include buckwheats (*Eriogonum nudum*, *E. saxatile, E. inflatum*), four o'clock (*Mirablis bigelovii*), Panamint parsley (*Cymopterus panamintensis*), prickly poppy (*Argemone munita*), and thistles (*Cirsium mohavense* and *C. neomexicanum*). When active, annual plants are the dominant cover on pure talus and cinder slopes. The composition is usually limited to a few dominant types, which flourish in the absence of competition. More gentle slopes with more developed soils have buckwheats (*Eriogonum deflexum, E. maculatum, E. nidularium, and E. rixfordii*), coreopsis (*Coreopsis bigelovii*), turtle plant (*Psathyrotes* spp.), phacelias (*Phacelias cryptantha, P. nashiana, and P. pedicellata*), satin blazing star (*Mentzelia involucrata*), vernal fiddleneck (*Amsinkia vernicosa*), scented cryptantha (*Cryptantha utahensis*), evening primroses (*Camissonia boothii* subsp., *C. claviformis*, and *C. brevipes*), woolly stars, rock gilia (*Gilia scopulorum*), and chia. There is great potential for undocumented species on cinder and talus slopes at NAWS-CL. This type of terrain is difficult to access. Past work in these areas has been minimal, yet very productive in locating noteworthy plant occurrences.

Canyon Bottom and Wash Scrub Subtype

Canyon bottoms in Mojave Mixed Scrub often have the highest perennial plant diversity of all NAWS-CL ecosystems, due to the blending of slope aspects and geomorphology types, the presence of riparian zones and seasonally moist washes, protection from exposure, and cool air drainage. Many plants characteristic of higher elevation plant communities establish their lowest occurrences in wash and riparian areas of canyon bottoms. Slope bottoms lose their characteristic shrub compositions as they drop into washes. Large shrubs dominate washes, while subshrubs and small perennials cling to the banks, rock outcrops, and nearby slopes. Riparian zones

contribute tall formations to canyon bottoms in Mojave Mixed Scrub, usually in upper portions of canyons. These zones are treated under the Riparian plant community description.

Shrubs characteristic of canyon bottoms include four-winged saltbush, rubber rabbitbrush, bush lupine, bladder sage, cheesebush, seepwillow (*Baccharis sergilloides*), scalebroom (*Lepidospartum squamatum*), allscale, brickellias (*B. microphylla, B. multiflora*), peach thorn, snakeweeds (*Gutierrezia microcephala* and *G. sarothrae*), western bush penstemon, brittlebush (*Encelia actonii*), sweetbush, and groundsel. Subshrubs and herbaceous perennials of canyon bottoms include nude buckwheat, Wright buckwheat (*Eriogonum wrightii*), rock lotus, melic grass (*Melica imperfecta* and *M. frutescens*), prickly poppy, purple three-awn, desert milkweed (*Asclepias erosa*), rattlesnake weed, rock nettle (*Eucnide urens*), ground-cherry (*Physalis crassifolia*), desert tobacco (*Nicotiana obtusifolia*), bushy bedstraw, Prince's plume, and thistles (*Cirsium* spp.). Annual cover is normally limited by rock outcrops and loose gravels. The most characteristic annuals of canyon bottoms are associated with washes and adjacent alluvial terraces, including monkey flower (*Mimulus bigelovii*), purple mat (*Nama demissum*), woolly sunflower (*Eriophyllum wallacei*), goosefoot (*Chenopodium fremontii*), purple root cryptantha (*Cryptantha micrantha*), annual buckwheats (*Eriogonum reniforme, E. pusillum, and E. palmerianum*), and thread plant (*Nemacladus* spp.).

Canyon bottoms are mostly typical of drainage zones that occur throughout Mojave Mixed Scrub on the North Range and the Slate Range of the South Range; however, most other areas on the South Range have more open drainages and washes at elevations where Mojave Mixed Scrub occurs. These wash zones usually have a lower diversity of perennial species. In general the shrub cover is less unique and often intermixed with alluvial terraces, floodplains, and bajada landforms. Shrubs characteristic of open wash zones of Mojave Mixed Scrub include indigo bush (*Psorothamnus arborescens* var. *arborescens*), cheesebush, peachthorn, Anderson thornbush, hop-sage, desert senna (*Senna armata*), desert almond (*Prunus fasiculata*), bladderpod (*Isomeris arborea*), bladder sage, allscale, four-winged saltbush, and Nevada joint-fir. Fewer herbaceous perennials are associated with these zones. Some characteristic types include dyssodia (*Adenophyllum cooperi*), rattlesnake weed, stillingia (*Stillingia paucidentata*), hole-in-the-sand plant (*Nicolletia occidentalis*), and desert milkweed. Annuals in open wash zones can be very abundant and diverse in years of ample rainfall. They are typical of other alluvial zones of Mojave Mixed Scrub.

Shadscale Scrub

Shadscale Scrub at NAWS-CL is defined where shadscale is dominant and homogeneously distributed. In some areas Shadscale Scrub will be defined where it is codominant with spinescale (*Atriplex spinifera*). Shadscale Scrub at NAWS-CL usually occurs over broad bajada slopes and basins between 3,500 and 5,000 feet (1,065–1,525 m) AMSL. Areas at NAWS-CL that typify Shadscale Scrub include the lower Cactus Flats region, small basins within the Coso Geothermal Area, Darwin Wash, and Lower Centennial Flat. From Lower Centennial Flat, Shadscale Scrub dominates alluvial stretches north of NAWS-CL throughout Darwin Mesa and Lee Flat. Some frequently associated species besides spinescale include Anderson thornbush, cheesebush, hop-sage, bud-sage, desert alyssum, and Nevada joint-fir. Less frequently associated shrubs include winterfat, allscale, spiny menodora, four-winged saltbush, snakeweed, burrobush, and horsebrush.

Other shrub formations occur at NAWS-CL where shadscale is common, but these are not defined as Shadscale Scrub plant communities. These formations include carbonate geology, in Mojave Mixed Scrub and Creosote Bush Scrub, Saltbush Scrub where other saltbush (*Atriplex* spp.) are dominant, and sandy transition areas within Alkaline Basin Scrub. Shadscale Scrub is a well-recognized plant community and one of the dominant series throughout the lower Great Basin Desert. In California, Shadescale Scrub blends with other plant communities and is described by different classification systems with a variety of associates, especially chenopod shrubs. At NAWS-CL it tends to be more associated with Mojave Mixed Scrub plant types.

The Shadscale Scrub community inhabits fine-grained alkaline soils of the Mojave and Great Basin Deserts. In some areas of the Mojave it also occurs on rocky soils with rapid drainage. This community provides important forage for browsing animals. During the dry season, kangaroo rats are also known to eat saltbush leaves, because they contain a higher amount of water than many other plants. The fastidious kangaroo rats scrape the salt off the leaves with their teeth first because ingesting salt would complicate absorption of water (Schoenherr 1992).

Hop-Sage Scrub

Hop-Sage Scrub at NAWS-CL is defined where hop-sage is the dominant cover. These cover series usually occur between 3,000 and 5,000 feet (915–1,525 m) AMSL. As with Shadscale Scrub, this community is defined in other regions with associates more typical of alkaline basins, but at NAWS-CL it is most frequently associated with Mojave Mixed Scrub. Areas at NAWS-CL where Hop-Sage Scrub occurs include Darwin Wash, Cactus Flats, Coso Geothermal Area, and the upper Slate Range. In these areas it sometimes occurs as nearly monotypic stands (as in the Darwin Wash area). It is most frequently associated with spiny menodora, Cooper's goldenbush, Anderson thornbush, shadscale, cheesebush, blackbrush, creosote bush, bud-sage, spinescale, winterfat, and burrobush. It is also frequent and sometimes dominant in the carbonate geology of NAWS-CL. Hop-sage occurs as a minor associate over much of NAWS-CL lands.

Creosote Bush Scrub

Creosote Bush Scrub is defined at NAWS-CL where creosote bush is the dominant or codominant cover, usually with burrobush. At NAWS-CL, Creosote Bush Scrub occurs from the lowest, well-drained, non-alkaline areas (1,400 feet [425 m] AMSL) up to 3,500 feet (1,070 m) AMSL. Above 3,500 feet AMSL, creosote bush still grows but is usually associated with a diverse shrub mixture that is more characteristic of Mojave Mixed Scrub, Shadscale Scrub, Joshua Tree Woodland, or Blackbrush Scrub. The Creosote Bush-Burrobush Series is the most widespread shrub association at NAWS-CL. Other shrubs frequently encountered in Creosote Bush Scrub include allscale, shadscale, indigo bush, goldenhead, cheesebush, desert senna, and Anderson thornbush.

Creosote bush is the dominant shrub of the Mojave and Colorado deserts. In total, Creosote Bush Scrub covers more land than any other vegetation community in California – over 21 million acres (Schoenherr 1992). Creosote bush is most common on well-drained soils of bajadas and flats. Common associated species in creosote bush scrub include burro bush (*Ambrosia dumosa*), shadscale, goldenrod (*Acamptopappus sphaerocephalus*), Mojave indigo bush, allscale, cheesebush (*Hymenoclea salsola* var. *salsola*), desert senna (*Senna armata*), and Anderson thornbush (*Lycium andersonii*) (Navy 2004).

The regular spacing of creosote bush on broad, flat terrain is remarkable; plants seem to be spaced with orchard-like regularity. It was once assumed that the spacing was due to a water-soluble chemical inhibitor, produced by the leaves or roots that prevented germination of creosote bush seeds in the vicinity of a mature plant. In well-watered areas, plants are taller and grow closer together. In spite of evidence that creosote bush roots inhibit those of bur-sage, no evidence has been developed to support the presence of an inhibitor that works between individual creosote bushes. At the present time, it is supposed that creosote bush is so efficient at absorbing water that germination of seeds is prohibited within the scope of a mature root system. The regular interval of spacing represents the reach of root systems of adjacent plants. Since water is distributed equally over these desert flats, the shrubs presumably all grow at the same rate; thus, they are equally spaced, because creosote bush lives for so long. These areas of regular spacing seem to represent even-aged stands.

Germination of creosote bush seeds, however, is not as difficult as the paucity of creosote bush seedlings may make it seem. Apparently, seeds germinate abundantly following winter rains, but they die very early of water

stress. This stress is accentuated if the seeds germinate within the scope of the root system of a mature plant. Perhaps more critical than that, however, is the effect of heat close to the ground. Heat accelerates water stress, and the temperature at ground level in the summer is near 160°F (71°C). Before its root system becomes established, creosote bush is unable to endure that kind of stress. Apparently, in nature young creosote bushes can only become established if there is a period of three to five years of cool, moist weather. Because this condition does not often occur, we do not find many young creosote bushes.

Creosote bush and bur-sage have small leaves, typical of evergreen plants in desert areas. The high surface to volume ratio of small leaves is believed to enhance cooling by radiation without increasing water loss. Evaporative water loss is reduced by resinous or waxy coatings. Creosote bush is renowned for the odor of its resinous coating, which is particularly pungent during and after rains, giving the entire desert a distinctive odor. As the dry season progresses, plants drop their leaves a few at a time.

The amount of detritus from leaf fall that accumulates around the base of these shrubs is significant. A whole community of detritus feeders, including beetles and millipedes, live beneath these shrubs. In addition, when the wind blows, more organic and inorganic material is caught by the shrubs. A mound of sand may be found at the base of every shrub, and numerous seeds are brought in by the wind. Many desert rodents, such as pocket mice and kangaroo rats, make their burrows in the soil at the base of these plants and feed on the seeds that collect there. The canopy of the shrub helps to conceal foraging animals from predators. Efficient pocket mice may never have to leave the protective canopy of the creosote bush under which they have their burrows.

Mojave Sand Field

Mojave Sand Field at NAWS-CL is defined for areas where sand deposits, usually aeolian, are thick enough to influence areas normally dominated by Mojave Mixed Scrub, Creosote Bush Scrub, or Saltbush Scrub. Influences of sand fields or stabilized dunes usually reduce or exclude large shrubs, with the exception of creosote bush, which often thrives and grows larger as a result of increased sandy soils. Creosote clones or "rings" occur most often in these areas. Where sands are fine and loose, very distinctive herbaceous plant compositions and annual plants occur. Extensive sand fields and dunes occur at NAWS-CL in the southern Argus Range, east of the China Lake basin. Elevations of these formations range from 2,200 to 3,800 feet AMSL.

Perennials characteristic of Mojave Sand Field include sandpaper plant (*Petalonyx thurberi* subsp. *thurberi*), locoweed (*Astragalus lentiginosus* var. *variablis*), Indian rice grass (*Achnatherum hymenoides*), stillingia (*Stillingia spinosa* and *S. paucidentata*), wooly star (*Eriastrum densifolium*), zigadenus (*Zigadenus brevibracteus*), hole-in-the-sand plant, prickly poppy, evening primrose (*Oenothera* spp.), and buckwheat (*Eriogonum plumatella*). Annuals growing on dunes and sand fields are rich and robust. Some of the most characteristic include desert dandelion (*Malacothrix glabrata*), coreopsis, sand-verbena (*Abronia pogonantha* and *A. villosa*), brown-eyed primrose (*Camissonia claviformis*), keysia (*Glyptopleura marginata*), sticky yellow-throats (*Phacelia bicolor*), desert twinbugs (*Dicoria canescens*), annual mitra (*Stephanomeria exigua*), various Gilia species, split grass (*Schismus arabicus* and *S. barbatus*), and chicory.

There are some plants that are exclusive to aeolian deposits and others that are characteristic of both aeolian deposits and other types of sand deposits, such as sandy washes, sandy slopes, or bajadas with meandering flash flood paths. This is especially true with granitic alluvium.

Desert Holly Scrub

Desert holly (*Atriplex hymenolytra*) is a patchy but locally dominant cover in widespread areas of NAWS-CL, usually occurring below 3,000 feet (915 m) AMSL. It is defined wherever Desert Holly Scrub is evenly distributed,

dominant or codominant with creosote bush or other saltbush. Distinctive examples of Desert Holly Scrub at NAWS-CL are found in the White Hills, Salt Wells Valley, Randsburg Wash Road south of Searles Lake, Wingate Pass, and numerous areas on southern bajadas and foothills of Straw Peak. Where desert holly is not the dominant species, it is usually associated with Creosote Bush Scrub or Saltbush Scrub (especially shadscale).

Saltbush Scrub

Saltbush Scrub on NAWS-CL is defined as areas where allscale or spinescale is clearly the dominant cover shrub, often to the exclusion of all other shrub species. At NAWS-CL these areas are below 5,000 feet (1,525 m) AMSL and occur primarily in Airport and China Lake basins, Coso Geothermal Area, Salt Wells Valley, Wingate Wash, Pilot Knob Valley, and Superior Valley. Allscale is the most widespread and abundant saltbush at NAWS-CL. It often forms exclusive stands near riparian areas, below the Creosote Bush Scrub zone or at the edge of playas. Spinescale generally grows in drier, less alkaline areas. It will intermix with both the allscale and shadscale series. Spinescale is widespread in Superior Valley and the southwestern Coso Mountains. Other shrub types contribute a minor portion of the cover in Saltbush Scrub. They are typical of adjacent plant communities, usually Alkaline Sink Scrub, Mojave Sand Field, or Creosote Bush Scrub.

Other saltbush species are the most frequently associated shrubs. Shadscale forms the most variable saltbush communities at NAWS-CL. More terrestrial associations are partially treated under Shadscale Scrub or Mojave Mixed Scrub, but it also occurs as a definite halophyte near playas and sinks, often closely associated with allscale or spinescale. Desert holly is scattered in rocky, well-drained areas of Saltbush Scrub at low elevations. These locations are normally too rocky and dry for other Atriplex species. However, desert holly is more typically associated with Creosote Bush Scrub than Saltbush Scrub. Four-winged saltbush appears in Saltbush Scrub in areas of disturbance, near seeps, or in washes. It is rarely a well-distributed cover, usually occurring as sparse individuals or as thickets with other tall shrubs. At higher elevations, four-winged saltbush is a more frequent associate in Saltbush Scrub. Torrey saltbush (*Atriplex lentiformis* subsp*. torreyi*) and Parry saltbush (*Atriplex parryi*) also occur in Saltbush Scrub but are most typically associated with Alkaline Sink Scrub.

Alkaline Sink Scrub

Alkaline Sink Scrub at NAWS-CL occurs where salt-tolerant plants grow as locally patchy covers, usually between more alkaline areas of playas and higher zones, usually with Saltbush Scrub. Some plants are also characteristic of maritime plant communities. Where plants are not growing on raised areas or sand fields, seasonally high water tables determine the shrub cover. Visually distinct subsets occur in Alkaline Sink Scrub at NAWS-CL. Some are probably best treated as separate plant communities. Among them are shrub series dominated by iodine bush, Parry saltbush, or bush seepweed. Areas with seeps and high water tables favor saltgrass covers. The most diverse subset of Alkaline Sink Scrub occurs in the sand fields of China Lake Basin. These have shrubs of higher zones intermixed with typical alkaline sink vegetation.

Characteristic species of Alkaline Sink Scrub include bush seepweed (*Suaeda moquinii*), red molly (*Kochia californica*), Parry saltbush, iodine bush (*Allenrolfea occidentalis*), intricate aster (*Machaeranthera carnosa*), rubber rabbitbrush, allscale, shadscale, and desert alyssum (*Lepidium fremontii*). Other perennials in Alkaline Sink Scrub include four-winged saltbush, tamarisk, indigo bush (*Psorothamnus arborescens* var. *arborescens*), Torrey saltbush, horsebrush (*Tetradymia glabrata*), goldenbush (*Isocoma acradenia*), Prince's plume (*Stanleya pinnata*), and saltgrass.

The least alkaline and driest areas in the community are characterized by saltbushes known as cattle spinach (*Atriplex polycarpa*) and wingscale (*Atriplex canescens*). These are both important forage species, and they

resemble each other. Where they occur together, they are difficult to tell apart. They both have narrow, elongate leaves. Wingscale, however, has distinctive fruits with flat, scale-like wings. Cattle spinach occurs in all deserts, but wingscale is more typical of coarser, drier soils of the Mojave and Colorado Deserts. They commonly grow on sandy mounds at the edges of playas or salinas (Schoenherr 1992).

In the Mojave Desert, these saltbushes are often associated with honey mesquite (*Prosopis glandulosa*). This deep-rooted shrub-like tree is a phreatophyte: it taps into permanent groundwater. These trees are often found on the edges on sand dunes growing out of a huge mound of sand, with a base of many buried trunks. There is often an abundance of dead wood beneath the mesquite canopy. However, what may appear as dead wood may simply be leafless. In the spring, the apparently dead branches come to life. Leaves are compound; each has a two-parted, wishbone-shaped stem (petiole) with many small leaflets. Mesquite is a legume (Fabaceae), and its beans are an important staple for desert animals, including coyotes.

As soil becomes more alkaline, plants increasingly have succulent leaves. These are still members of the saltbush family. A transitional species between slightly salty and very salty soils is a conspicuous, low, blue-gray plant known as inkweed or desert blite (*Suaeda torreyana*). This plant can tolerate salinity up to 1.0% (10,000 parts per million). In many playa areas, this is the last species encountered before the lake bed becomes bare.

The "champion" desert halophyte is iodine bush. One species, Parrish's glasswort (*Salicornia subterminalis*), may co-occur with iodine bush in the Alkali Sink community. These plants have deep taproots and absorb salt and water. By storing water in their tissues, these plants dilute the concentration of salts; thus, they become more and more succulent as they grow. Small sections at the tips of the stems eventually dry out, die, and fall off; in this way salts are shed by the plant. These plants grow on the edge of water that is over 2.0% salt (20,000 parts per million) (Schoenherr 1992).

Vernal Playa

Vernal Playa is defined for areas ranging from vernal pools to flooded alkaline basins. These are normally barren with clays and alkalis but become flooded on occasion, producing open to patchy growths of annuals and weedy species. These areas are characterized by geology consistent with clay deposition, standing water, and, for most of the time, a lack of vegetation. In the desert, only the highest rainfall in combination with the right season will reveal specialized annuals or biennials, which are characteristically associated with lake, pool, or playa shore edge. NAWS-CL has numerous dry lakes, playas, and clay depressions, ranging from small clay depressions and pools in the basalt flows up to 7,500 feet (2,290 m) AMSL in the northern Coso Range to alkaline and semi-alkaline playas in China Lake Basin, Salt Wells, and southern Panamint Valley (1,400–2,400 feet [425–730 m] AMSL).

Nonindigenous species are the most characteristic plants of these areas. In years of abundant rainfall, tumble mustards (*Brassica* and *Sisymbrium* spp.), chamomile (*Chamomilla occidentalis*), storks bill, and can form dense areas of cover on perimeters of depressions, pools, and playas. Native annuals such as fiddleneck, annual Atriplex species, and stinkweed (*Cleomella* spp.) are also common and characteristic. Tamarisk is an exotic perennial tree associated with playa depressions in the China Lake Basin. Saltgrass, bush seepweed, allscale, and occasionally iodine bush are other perennials associated with similar areas. Allscale is the most characteristic shrub of Vernal Playa on NAWS-CL lands. No endemic plants have been documented at NAWS-CL specifically associated with seasonal pools of water; however, these areas at NAWS-CL have not been surveyed well in the best years of ephemeral plant production.

On the North Range, Carricut Lake and upper Junction Wash have the most seasonally consistent areas of Vernal Playa due to the greater rainfall and low-alkaline sandy clays. Weeds, such as mustard (*Brassica tourfourtei*),

Russian thistle, and poverty weed (*Iva axillaris*), are usually present in all but the driest years. Vinegar weed (*Lessingia lemmoni*) and Coyote tobacco (*Nicotiana attenuata*) are native annuals that concentrate in the Carricut Lake area. Another prominent example of Vernal Playa vegetation at NAWS-CL can be seen at the northern end of Airport Lake, which supports a broad field of fiddleneck.

Areas near playas that become raised with soil deposition (human, alluvial, or windblown) are colonized by Parry saltbush.

Mojave Wash Scrub

Mojave Wash Scrub at NAWS-CL is defined in areas typically surrounded by Creosote Bush Scrub, where washes provide extra ephemeral moisture and create distinct shrub associations. Shrub associations are usually very specific with fewer, taller species that extend up and down washes for long stretches. These wash communities occur at the lowest elevations at NAWS-CL and intergrade with Mojave Mixed Scrub at elevations of 3,000 to 4,000 feet (915–1,220 m) AMSL (see Mojave Mixed Scrub – Canyon Bottom and Wash Zone). Dominant shrubs vary depending on hydrologic and geologic factors.

Higher elevations of Mojave Wash Scrub can be dominated by gum-leaved brickellia, scalebroom, four-winged saltbush, rubber rabbitbrush, peachthorn, indigo bush, bladdersage, allscale, and cheesebush. Lower elevations are often dominated by desert senna or cheesebush. Cheesebush is probably the most characteristic shrub of low elevation washes at NAWS-CL. The lowest elevation washes at NAWS-CL are often very distinct from surrounding Creosote Bush Scrub. These areas are subject to strong flash floods. Blackband rabbitbrush (*Chrysothamnus paniculatus*), pygmy cedar, and allscale are primary shrubs for these zones. Associated shrubs usually include those found in Creosote Bush Scrub and sometimes those typical of Mojave Mixed Scrub, which are able to survive at lower elevations because of wash hydrology. Some washes have little or no effect on overall plant composition, while geographically similar washes will have distinct shrub associations easily seen at a distance. In general, all washes change the composition of plant communities, even if only annual species. Washes and drainages affect most plant communities at nearly any elevation, but in general, the most distinct plant communities of washes at NAWS-CL are found in lower elevation areas with Creosote Bush Scrub and Mojave Mixed Scrub.

Riparian

Riparian areas are plant communities contiguous to and affected by surface and subsurface hydrologic features of perennial or intermittent lotic and lentic water bodies (rivers, streams, lakes, or drainage ways). Riparian areas have one or both of the following characteristics: 1) distinctively different vegetative species than adjacent areas, and 2) species similar to adjacent areas but exhibiting more vigorous or robust growth forms. Riparian areas are usually transitional between wetland and upland.

Riparian is defined at NAWS-CL where there are plants that need a permanent source of water or a substantial ephemeral flow. Typically these areas are found at springs and seeps: highly restricted, well-defined zones characterized by aquatic herbs, grasses, tall shrubs, and trees in active growth stages throughout summer. Dominant cover species vary greatly among riparian plant associations at NAWS-CL. Most riparian plant types can become exclusive cover in favorable microhabitats. A typical riparian zone at NAWS-CL consists of various vegetation patches, each dominated by a single species, including willows (*Salix* spp.), Freemont cottonwood (*Populus fremontii* var. *fremontii*), seepwillow (*Baccharis sergiloides*), and rushes (*Juncus* spp.), but plant species range with elevation and hydrology at a particular site (Navy 2004). More classified vegetation types exist for riparian plants and communities because each species can potentially be a dominant cover series. In regions where wetlands and climate create broader riparian zones, these community types have the same importance as terrestrial

plant communities. In desert regions, however, riparian zones are very narrow and restricted. For NAWS-CL purposes, various cover series of riparian plants have been lumped under one riparian community type. These are characterized by the hydrology and range from mesic montane microhabitats to highly alkaline, low elevation seeps and wetlands. Plants that are terrestrial at higher elevations are often restricted to riparian areas at lower elevations. These should be treated as indicating cover types of lower elevation riparian zones.

Saltgrass replaces Saltbush Scrub and Alkaline Sink Scrub in the Lark Seep region. Summer cypress, rushes, and tamarisk are other species in the Lark Seep area.

Disturbed Vegetation

Disturbed Vegetation is not a natural plant community but a plant assemblage characterized by invasive or nonindigenous species, usually a result of soil disturbance such as compaction. Because Disturbed Vegetation is often associated with human activity zones, its mapped outlines tend to be geometric and conspicuous. Disturbed areas are widespread and numerous at NAWS-CL. They are most frequently caused by human land use but can similarly be created by feral ungulates, rapid erosion, or flash floods. Some native species that tolerate disturbed conditions are semi-woody, short-lived shrubs such as cheesebush (*Hymenoclea salsola*); however, the majority of species are herbaceous, mostly annual plants. Nonindigenous plants influence nearly all disturbed areas, and create ecological pressures on surrounding plant communities when they populate vigorously enough to compete with native vegetation.

Riparian, Vernal Playa, and Mojave Wash Scrub are plant communities which receive natural flood disturbances. They have elements of disturbed or successional plant communities and share many of the same species as, for example, roadside disturbance areas. Disturbances at lower elevations of Creosote Bush Scrub are often followed with allscale shrub covers. These communities are frequent in the China Lake area and Ridgecrest. Higher areas of Creosote Bush Scrub, when disturbed, are often replaced with cheesebush. Tumbleweeds (*Salsola kali*) are the annual plant cover of the Drop Zone and other target areas. Annual ragweed (*Ambrosia acanthicarpa*) is frequent along roadsides in sandy areas.

Fiddleneck (native), non-native cheatgrass (*Bromus tectorum*), and non-native foxtail chess (*B. madritensis* subsp. *rubens*) are abundant and widespread species throughout NAWS-CL. They occur in nearly all plant communities and can become dominant plant cover without significant disturbance especially on wind-deposited sandy sites (J. Kellogg, pers.obs.). The abundance of *Bromus* grasses in lava flows allows fires to spread more rapidly. Such fires induced by exotic grasses have dramatically altered high desert vegetation in northwestern Arizona, Nevada, and Utah. Wild Horse Mesa at NAWS-CL has been altered in a similar manner.

Fiddleneck has the widest elevation range of NAWS-CL weedy species. It dominates a large marshy area north of Airport Lake. This dense fine fuel source has become of high concern in regards to fire danger and the opportunity for fires to spread rapidly within weed dominated communities.

Bush wooly star, freckled milk-vetch, stillingia, sandpaper plant, dicorea, and annual ragweed are disturbance replacements in Mojave Sand Field areas, particularly over the K2 Track on the North Range. In Great Basin plant communities, rabbitbrush, snakeweed, and four-winged saltbush are indicators of previously disturbed sites. Buckwheats are initial annual covers in many plant communities after severe disturbances.

Urban Exotics

Urban exotics are comprised of certain invasive and non-native species resulting from disturbance, such as human activities, overuse by feral domestic species, fires, rapid erosion, or flash flood. The disturbance replaces the existing plant community with a specific composition of plants that favor disturbed sites. Species common in disturbed sites are: devil's lettuce; tumbleweed (*Salsola tragus*), which are the annual cover at target areas; annual ragweed (*Ambrosia acanthicarpa*), which occur along roads; and nonnative grasses, such as annual cheat grass and downy chess (*Bromus madritensis* spp. *rubens*), which are present throughout NAWS-CL (Navy 2004).

Table L-1. Mapping units and plant communities at Naval Air Weapons Station China Lake.

NAWS-CL Mapping Unit	Defining Species	Terrestrial Natural Communities (Holland 1986)[2]	Biotic Communities (Brown et al. 1982)[2]	Manual of California Vegetation (Sawyer et. al 2009)[2]	CNDDB Rank[1]
Pinyon Woodland	Pinyon pine (*Pinus monophylla*)	72210 Mojavean Pinyon Woodland 72122 Great Basin Pinyon Woodland	122.4 Great Basin Conifer Woodland - 122.41 Pinyon- Juniper series	Singleleaf Pinyon Woodland Alliance [87.040.00]	G5 S4
Great Basin Mixed Scrub	Bitterbrush (*Purshia tridentata*)	35100 Great Basin Mixed Scrub – Bitterbrush 35210 Big Sagebrush - Bitterbrush 35300 Sagebrush Steppe - Bitterbrush	122.4 Great Basin Montane Scrub - 122.41 Bitterbrush Series	Bitterbrush Scrub Alliance [35.200.00]	G4 S3
Sagebrush Scrub	Big sagebrush (*Artemisia tridentata*)	35100 Great Basin Mixed Scrub - Big sagebrush 35210 Big Sagebrush - Big sagebrush 35300 Sagebrush Steppe - Big sagebrush	122.4 Great Basin Montane Scrub·- 122.41 Bitterbrush Series	Big Sagebrush Alliance [35.110.00]	G5 S5
Blackbrush	Blackbrush (*Coleogyne ramosissima*)	34300 Blackbrush Scrub	108: Blackbrush	Blackbrush Scrub Alliance [33.020.00]	G5 S4
Joshua Tree Woodland	Joshua tree (*Yucca brevifolia*)	73000 Joshua Tree Woodland 34210 Mojave Mixed Woody Scrub - Joshua tree 34220 Mojave Mixed Steppe - Joshua tree	154.1 Mohave Desert scrub – 153.15 Joshua tree Series	Joshua Tree Woodland Alliance [33.170.00]	G3 S3
Desert Transition Scrub	Showy goldenbush (*Ericameria linearifolia*)	73000 Joshua Tree Woodland 34210 Mojave Mixed Woody Scrub - Joshua tree 34220 Mojave Mixed Steppe - Joshua tree	152.1 Great Basin Desert Scrub – 152.16 Mixed Scrub Series	Narrowleaf Goldenbush Scrub Provisional Alliance [38.125.00] Transition Desert Category (Beatley, 1976)	G3 S3
Mojave Mixed Scrub	Bladder sage (*Salazaria mexicana*)	73000 Joshua Tree Woodland 34210 Mojave Mixed Woody Scrub - Joshua tree 34220 Mojave Mixed Steppe - Joshua tree	153.1 Great Basin Desert Scrub - 152.16 Mixed Scrub Series 153.1 Mojave Desert Scrub - 153.11 Creosote Bush Series 153.1 Mojave Desert Scrub - 153.14 Bladder Sage Series 153.1 Mojave Desert Scrub - 153.15 Joshua Tree Series	Bladder Sage Scrub Alliance[33.310.00]	G4 S4
Hop-sage Scrub	Spiny hop-sage (*Grayia spinosa*)	36100 Desert Chenopod Scrub 36140 Shad scale Scrub	152.1 Great Basin Desert Scrub	Spiny Hop Sage Scrub Alliance [33.180.00]	G5 S3
Shadscale Scrub	Shadscale (*Atriplex confertifolia*)	36100 Desert Chenopod Scrub – Shadscale 36140 Shadscale Scrub - Shadscale	152.1 Great Basin Desert Scrub – 152.12 Shadscale Series	Shadscale Scrub Alliance [36.320.00]	G5 S4
Mojave Wash Scrub	Cheesebush (*Hymenoclea salsola*)	34210 Mojave Mixed Woody Scrub – 34240 Mojave Wash Scrub - 36110 Desert Saltbush Scrub - Allscale 36110 Desert Saltbush Scrub - Four-wing saltbush 63000 Riparian Scrub - Scalebroom 63700 Mojave Desert Wash Scrub - Scalebroom	153.1 Mojave Desert Scrub – 153.11 Creosote Bush Series 153.1 Mojave Desert Scrub - 153.14 Bladdersage Series	Cheesebush Scrub Alliance [33.200.00]	G5 S4

NAWS-CL Mapping Unit	Defining Species	Terrestrial Natural Communities (Holland 1986)[2]	Biotic Communities (Brown et al. 1982)[2]	Manual of California Vegetation (Sawyer et. al 2009)[2]	CNDDB Rank[1]
Mojave Sand Field	Clonal creosote bush rings (*Larrea tridentata*)	22100 Active Desert Dunes 22200 Stabilized and Partially Stabilized Dunes 22300 Stabilized and Partially Stabilized Desert Sand Fields 34100 MoJave Creosote Bush Scrub	152.1 Mojave Desert Scrub – 152.12 Hymenoclea Series	Creosote Bush Scrub Alliance [33.010.00]	G5 S5
Creosote Bush Scrub	Creosote bush (*Larrea tridentata*)	34000 Mojavean Desert Scrubs 34100 Mojave Creosote Bush Scrub	152.1 Mojave Desert Scrub – 152.11 Larrea Series	Creosote Bush Scrub Alliance [33.010.00]	G5 S5
Desert Holly Scrub	Desert holly (*Atriplex hymenelytra*)	36000 Chenopod Shrubs - Desert holly 36100 Desert Chenopod Scrub - Desert holly 36110 Desert Saltbush Scrub - Desert holly	152.1 Great Basin Desert Scrub – 152.12 Shadscale Series	Desert Holly Scrub Alliance [36.330.00]	G5 S4
Saltbush Scrub	Allscale (*Atriplex polycarpa*)	36000 Chenopod Shrubs – Allscale 36000 Chenopod Shrubs - Mixed salt bush 36000 Chenopod Shrubs - Spinescale 36100 Desert Chenopod Scrub - Allscale 36100 Desert Chenopod Scrub - Mixed saltbush 36100 Desert Chenopod Scrub - Spinescale 36110 Desert Saltbush Scrub - Allscale 36110 Desert Saltbush Scrub - Mixed saltbush 36110 Desert Saltbush Scrub - Spinescale	152.1 Great Basin Desert Scrub - 152.17 Saltbush Series 153.1 Mojave Desert Scrub - 153.17 Saltbush Series	Allscale Scrub Alliance [36.340.00]	G5 S4
Alkaline Sink Scrub	Bush seepweed *(Suaeda moquinii*)	36000 Chenopod Shrubs 36100 Desert Chenopod Scrub - Bush seep weed 36100 Desert Chenopod Scrub - Iodine bush 36100 Desert Chenopod Scrub - Mixed saltbush 36120 Desert Sink Scrub - Bush seepweed 36120 Desert Sink Scrub - Iodine bush 36120 Desert Sink Scrub - Mixed saltbush	152.1 Great Basin Desert Scrub - 152.12 Shadscale Series 152.1 Great Basin Desert Scrub - 152.17 Saltbush Series 153.1 Mojave Desert Scrub - 153.17 Saltbush Series 253.4 Mojavean Interior Strand - 253.42 Mixed Scrub Series	Bush Seepweed Scrub Alliance [36.200.00]	G5 S3
Vernal Playa	Barren, or sparse native and exotic annuals	36120 Desert Sink Scrub 44400 Vernal Pools 46000 Alkali Playa Communities 52500 Vernal Marsh	152.1 Great Basin Desert Scrub	No corresponding Alliance	

NAWS-CL Mapping Unit	Defining Species	Terrestrial Natural Communities (Holland 1986)[2]	Biotic Communities (Brown et al. 1982)[2]	Manual of California Vegetation (Sawyer et. al 2009)[2]	CNDDB Rank[1]
Riparian	Willows (Salix spp.), Freemont cottonwood (Populus fremontii), broom baccharis (Baccharis sergiloides), and rushes (Juncus spp.). Non-native salt cedar (Tamarisk spp.) may also dominate.	45310 Alkali Meadows 45320 Alkali Seep 45400 Freshwater Seep 52420 Transmontane Freshwater Marsh 52300 Alkali Marsh 52320 Transmontane Alkali Marsh	222.2 Plains and Great Basin Riparian Deciduous Forest - 222.21 Cottonwood-Willow Series 222.4 Sierran- Cascade Riparian Scrub - 222.41 Cottonwood-Willow Series 223.2 Interior Southwestern Riparian Deciduous Forest and Woodland 223.21 Cottonwood-Willow Series 223.3 Californian Riparian Deciduous Forest and Woodland 223.31 Cottonwood-Willow Series 233.2 Interior Southwestern Swamp and Riparian Scrub - 233.21 Mixed Narrowleaf Series 233.3 Interior Southwestern Swamp and Riparian Scrub	Fremont Cottonwood Forest Alliance [61.130.00] Shining Willow Alliance [61.204.00] Red Willow Alliance [61.205.00] Sandbar Willow Alliance [61.209.00] Arroyo Willow Alliance [61.201.00] Broom Baccharis Alliance [63.530.00] Tamarisk Thickets - Semi-natural Stand [63.810.00]	G4 S3 G4 S3 G3 S3 G5 S4 G4 S4 G4 S3
Riparian (continued)		52420 Transmontane Freshwater Marsh 52500 Vernal Marsh 61320 Southern Arroyo Willow Riparian Forest -Arroyo willow 61320 Southern Cottonwood-Willow Riparian Forest - Mixed willow 61700 Mojave Riparian Forest 62000 Riparian Woodlands - Arroyo willow 63300 Southern Riparian Scrub - Mixed willow 63320 Southern Willow Scrub 63700 Mojave Desert Wash Scrub 63810 Tamarisk Scrub	23 Disclimax Saltcedar Series 233.3 California Deciduous Swamp and Riparian Scrub - 233.31 Mixed Narrowleaf Series 242.5 Great Basin Interior Marshland - 242.51 Rush Series 242.5 Great Basin Interior Marshland - 242.52 Saltgrass Series 243.6 California Interior Marshland - 243.61 Cattail Series 253.4 Mohavian Interior Strand - 253.42 Mixed Scrub Series 243.4 Mohavian Interior Marshland - 243.41 Rush Series 243.4 Mohavian Interior Marshland - 243.42 Saltgrass Series		
Disturbed vegetation	Cheatgrass (*Bromus tectorum*) and native and non-native annuals	42200 Non-Native Grassland	143.2 Californian Valley Grassland - 143.21 Annual Disclimax Grassland	Cheatgrass Grassland Semi-natural Stand [42.020.00]	

NAWS-CL Mapping Unit	Defining Species	Terrestrial Natural Communities (Holland 1986)[2]	Biotic Communities (Brown et al. 1982)[2]	Manual of California Vegetation (Sawyer et. al 2009)[2]	CNDDB Rank[1]

[1] CNDDB - California Natural Diversity DataBase rank.
Global Rank: The global rank is a reflection of the overall condition of an element throughout its global range.
G1 = Less than 6 viable element occurrences or less than 1,000 individuals or less than 2, 000 acres.
G2 = 6-20 element occurrences or 1,000 -3,000 individuals or 2,000 - 10,000 acres.
G3 = 21-100 element occurrences or 3,000-10,000 individuals or 10, 000 - 50,000 acres.
G4 = Apparently secure; this rank is lower than 03 but factors exist to cause some concern; i.e. there is some threat, or somewhat narrow habitat.
G5 = Population or stand demonstrably secure to ineradicable due to being commonly found in the world.
State Rank: The state rank is assigned much like the global rank, except state ranks in California often also contain a threat designation attached to the "S" rank.
S 1 = Less than 6 element occurrences or less than 1,000 individuals or less than 2,000 acres.
SI.I = Very threatened.
SI.2 = No current threats known.
SI.3 = Very threatened.
S2 =6-20 element occurrences or 1,000 -3,000 individuals or 2,000 - 10,000 acres.
S2.1 = Very threatened.
S2.2 = No current threats known.
S2.3 = Very threatened.
S3 = 21-100 Element occurrences or 3,000-10,000 individuals or 10,000 - 50,000 acres.
S3.1 = Very threatened.
S3.2 = No current threats known.
S3.3 = Very threatened.
S4 = Apparently secure within California; this rank is clearly lower than S3 but factors exist to cause some concern; i.e. there is some threat, or somewhat narrow habitat. No threat rank.
S5=- Demonstrably secure to ineradicable in California. No threat rank.
[2] References:
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Holland, RF. 1986. Preliminary Descriptions o/the Terrestrial Natural Communities o/California. California Department of Fish and Game, Sacramento, CA. 156 pp.
Sawyer, J.O., T. Keeler-Wolf, and J. Evens. 2009. A Manual of California Vegetation 2nd Edition. California Native Plant Society.
* CNDDB rank for nearest Holland type.

Appendix M: Wild Horse and Burro Management Plan

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NAWS/China Lake

Wild Horse and Burro Management Plan

Final
November 2013

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EXECUTIVE SUMMARY

Despite the removal since the early 1980s of approximately 10,500 burros and 3,540 horses from the Naval Air Weapons Station China Lake (NAWS-CL) at a cost of approximately $5,000,000, target management levels have not been reached. In accordance with the Wild Free-Roaming Horse and Burro Act, California Desert Protection Act, and the California Desert Conservation Area (CDCA) Plan, NAWS-CL has implemented a vigorous herd reduction program, successfully reducing the burro population from an estimated 3,500-5,700 animals in 1981 to the current population of approximately 150 animals. In addition, horse populations likewise have been reduced from an estimated 1,300 animals in 1982 to a 2009 population estimate of 300 animals. Since 2009, the population has spiked to an estimated 532 animals.

With horse and burro numbers now exceeding their targeted levels, NAWS-CL has identified the opportunity to implement enhanced management efforts and the need for an up-to-date comprehensive Wild Horse and Burro Management Plan (WHBMP). This WHBMP discusses the current status of the horse and burro herds, and provides new wild horse management prescriptions.

The Goals of this WHBMP are to:

- Maintain the Centennial Horse Herd within a range of 100 to 168 animals to allow for range recovery, and to maintain genetic variability and herd health. Allow for changes in this initial range over time based on habitat condition, vegetation utilization, animal numbers and distribution, and herd health.
- Achieve and maintain the burro population at zero.
- Keep the Herd healthy and self-sustaining by maintaining and improving rangeland condition. Remaining horses will be healthier and better able to survive stressful periods such as prolonged droughts and harsh winters when the rangeland resource is in a self-sustaining condition.
- Maintain herd genetic variability/diversity by periodically conducting genetic analysis on the horse herd and, if warranted, by the possible introduction of animals from other suitable herd areas, removal of young animals, and/or by increasing the number of male horses and therefore the number of possible harems.
- Implement a proactive fertility control program through the application of contraceptive to breeding age mares.
- Increase the health and adoptability of horses by taking only young animals when extracting excess, by allowing the breeding herd to live out their lives on the range, and by carefully selecting the young animals to be retained. The younger animals are more marketable to the adopting public, and the herd genetic quality will improve through thoughtful selection of breeding herd recruitment.
- Minimize the cost of reducing and maintaining desired population levels.
- Minimize damage to water resources, riparian areas, uplands, and cultural resources through Herd reduction, and thereby facilitate and increase the rate of native plant and animal population recovery, including federally listed species.

- Provide for an enhanced habitat assessment program to monitor forage utilization and recovery) and an animal monitoring program to document herd size, health, and distribution.

The subjects relevant to wild horse management examined in depth in this document, include Appropriate Management Levels and census techniques, and the humane gathering, removal, fertility control, sex ratio, adoption, herd monitoring, and genetic variability. Modeling is applied to analyze four Management Strategies using the Jenkins Model "WinEquus," and detailed management recommendations are provided. The findings demonstrate that the current management practices are not sustainable financially or ecologically. Removals are not keeping up with recruitment and a population crisis could be looming.

Management Strategy 1 considers the existing management program with no changes. The Strategy would allow for removal of all burros encountered but only the removal of young (2 to 3 year-old) horses. The results from the model show that the Management Strategy does not control the growth of the herd, and that it will continue to grow. After 11 years, the herd could exceed 1,600 animals with a projected ten-year cost of $1,040,600.

Management Strategy 2 applies a gate-cut gather and removal of horses every two years to bring the population down to the lower level of the AML range (100 animals). This approach achieves AML immediately which is beneficial for the habitat, but it creates a significant loss of genetic variability at extreme expense due to the large number of unadoptable horses that must be placed in long term holding. The projected ten-year cost is $2,243,300. All burros encountered may be removed during these gather efforts.

Management Strategy 3 implements an 80 percent gather of horses on a four-year cycle. This incurs a one-time but significant expense in the first gather to remove enough horses (including unadoptables) to reach lower AML. This is followed by implementation of fertility control to diminish the recruitment rate, plus removal of only two-year-olds and younger that are highly adoptable. The breeding herd will live out their life on the range. The projected ten-year cost is $1,887,850. All burros encountered may be removed during these gather efforts.

Management Strategy 4 implements an 80 percent gather of horses on a three-year cycle without a large front-end gather. No unadoptables are removed, so the achievement of AML is stretched out to 20 years. A fertility control regime is implemented to diminish the recruitment rate, plus only two-year-olds and younger are removed for adoptability. The breeding herd will live out their life on the range. The projected ten-year cost is $1,374,200. All burros encountered may be removed during these gather efforts.

Existing management could result in the Centennial Herd tripling in ten years. If the tripling is allowed to occur, it could cost $5 million or more to get the wild horse population under control and back to a level where horse herd health assured and habitat conditions can improve. With that in mind, the management recommendation is Management Strategy 3, Management Strategy 4, or a blend of the two. Blending would provide the Strategy to remove lower numbers of unadoptable horses at the outset, coupled with commensurate extensions of time to get to AML. Additionally, Management Strategy 1 should continue to be used to do selective roping on short budget years so that, at a minimum, the rate of horse herd population growth is reduced.

The selection of a particular management strategy in any given year may be dependent on: the need to conduct a roundup; the timing (season) during which gathers may take place; funding availability; access restrictions to gather sites; ability of BLM to gather, process and adopt animals; and the availability of sanctuaries for older horses.

As stated already, the Centennial Herd population is now over 530 horses. In order to get the herd down to AML (100 to 168), fertility control must be applied to restrain annual herd recruitment. A license to use fertility control must be applied for and a commitment made to apply initial and follow-up treatments on a systematic schedule. The management budget must become sufficient and reliable in order to accomplish the task and avoid continually increasing costs at a later date.

The habitat monitoring program now in place does not currently provide resource information on whether horse use (or other factors) affects the vegetation resource and functionality in riparian areas associated with springs or limited perennial water sources that occur within the North Range. A qualitative assessment method that has already been developed and is recommended for monitoring riparian areas is the Properly Functioning Condition Assessment Method.

Cooperative management with agency partners was examined in the context of the whole ecosystem in which the Centennial Wild Horse Herd and the burros live. Recommendations for enhanced agency partnerships are made since the Herd roams on lands administered by NAWS-CL, the Bureau of Land Management (BLM), Death Valley National Park (operated by the U.S. National Park Service), and National Training Center (NTC) Fort Irwin. An existing Memorandum of Understanding between NAWS-CL and the BLM is the mechanism for cooperation on horse and burro management efforts. The Navy and BLM currently cooperate in matters of joint responsibility such as conducting census, gathering excess animals, removing excess animals, and planning and budgeting the cooperative activities.

For burros, considerable time and expense is devoted to capturing and removing burros that propagate from residual reservoirs of animals on lands of neighboring agencies, the Death Valley National Park, NTC Fort Irwin, and BLM. All agencies including the Navy are gradually losing ground in their efforts to achieve a zero population level. The four agencies are encouraged to develop a comprehensive joint census and removal plan to achieve their objectives, decrease funding requirements, and achieve the zero-population goal. The plan should detail the ways, means, and schedule that will be used to cooperatively accomplish the mutual zero objective for burros.

Reliable funding is essential to maintain the integrity of this finely tuned management. Gaps in funding cause the loss of investment to date, and precipitate a major setback in the program. A substantial front-end investment is required to stabilize the horse herd, but that is soon recovered by a 50 percent or more reduction in the annual maintenance costs thereafter. The resulting maintenance costs are less than half of the other Management Strategies – roughly an average of $35,000 per year. This funding is essential to address impact of the wild horses and burros to natural resources including federally listed species, as well as cultural resources, and avoid impacts to the military mission.

This is a long-term plan subject to annual review and amendment. Once approved, this Plan will be incorporated into the NAWS-CL Integrated Natural Resources Management Plan, which is currently being updated.

ABBREVIATIONS/ACRONYMS

AML	Appropriate Management Level
AUL	Authorized Use List
AUM	Animal Units per Month
BLM	Bureau of Land Management
CDCA	California Desert Conservation Act or Area
CDPA	California Desert Protection Act
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMD	Environmental Management Division
EPA	Environmental Protection Agency
EPMD	Environmental Planning and Management Department
FDA	Food and Drug Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FLPMA	Federal Land Policy Management Act
USFS	Forest Service
GAO	General Accounting Office
HMA	Herd Management Areas
HSUS	Humane Society of the United States
INRMP	Integrated Natural Resources Management Plan
kg	kilogram
km	kilometer
km2	squared kilometers
LCM	Lacey-Cactus-McCloud
m	meters
MOU	Memorandum of Understanding
NAWS	Naval Air Weapons Station
NAWS-CL	Naval Air Weapons Station at China Lake
NPS	National Park Service
NRCS	Natural Resources Conservation Service
PFC	Proper Functioning Condition
PRIA	Public Rangelands Improvement Act
PZP	Porcine Zona Pellucida
RCI	Resource Concepts, Inc.
Station	Naval Air Weapons Station at China Lake
TGA	Taylor Grazing Act
The Plan	Wild Horse and Burro Management Plan
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VHF	Very High Frequency
WH&B	Wild Horses and Burros
WHBA	Wild Free-Roaming Horses and Burros Act
WHBMP	Wild Horse and Burro Management Plan

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APPENDICES

1.0 INTRODUCTION

The removal of wild horses and burros was first implemented on the Naval Air Weapons Station at China Lake (NAWS-CL or Station) in the early 1980s. These gathers were necessitated by an acute overpopulation of animals and the resulting adverse effect they were having on Navy operations, safety, range facilities, cultural and natural resources, and overall horse and burro health. In 1981 and 1982, NAWS-CL prepared an Environmental Assessment (EA) and Environmental Impact Statement (EIS) in support of their management program for wild horses and burros, which was implemented as an element of the California Desert Conservation Area (CDCA) Plan. The CDCA Plan specifically addressed the issue of wild horse and burro management at NAWS-CL. The CDCA Plan determined that lands within NAWS-CL carried rangeland resource capacity sufficient to support a target population of 168 horses. Burro population levels were initially determined to be 1137 burros in the Centennial Herd Management Area (HMA) and 408 burros in the Slate Range HMA. Due to conflicts with military operations Amendment 24 to the CDCA plan was approved and established an appropriate herd level of zero burros in this HMA.

In the 30 years since the implementation of the CDCA Plan, rangeland conditions, population levels of burros and horses, and stocking rates of domestic livestock within NAWS-CL have changed significantly. In accordance with the CDCA Plan, NAWS-CL has implemented a vigorous herd reduction program successfully reducing the burro population from an estimated population of 3,500 - 5,700 animals in 1981 to the current population of approximately 150 animals. In addition, horse populations have likewise been reduced from an estimated 1,300 animals in 1982 to the current population estimate of approximately 300 animals. Since the management program began, more than 10,500 burros and 3,540 horses have been removed from the NAWS-CL at a cost of approximately $5,000,000.

For the past 20 years, management efforts have been almost entirely directed towards reducing the numbers of horses and burros at NAWS-CL. With horse and burro numbers approaching their targeted herd population levels, NAWS-CL has identified the opportunity to implement enhanced management efforts and the need for an up-to-date comprehensive Wild Horse and Burro Management Plan (WHBMP). This WHBMP discusses the current status of the horse and burro herds, ongoing management efforts, and provides new wild horse management prescriptions. Recommendations are made to achieve the burro objective of zero population. This WHBMP is a long-term planning document subject to annual review and amendment. Once approved, this WHBMP will be incorporated into the NAWS-CL Integrated Natural Resources Management Plan (INRMP), which is currently being updated.

1.1 REGULATORY FRAMEWORK

1.1.1 Regulatory Background

On 15 December 1971, Congress passed legislation to protect, manage, and control wild horses and burros on public lands. The Wild Free-Roaming Horse and Burro Act (WHBA [Public Law (P.L.) 92-195]) described these animals as "fast-disappearing symbols of the historic and pioneer spirit of the West." The 1971 WHBA defined the policy that wild horses and burros were to be considered an integral part of the natural system on public lands and that wild, free-roaming horses and burros shall be protected from capture, branding, harassment, or death. It further mandated that all free-roaming horses and burros be managed under the care of either the Secretary of the Interior for herds on U.S. Bureau of Land Management (BLM) lands, or the

Secretary of Agriculture for herds on U.S. Forest Service (USFS) lands. The WHBA specifies that wild horses and burros may be managed only on lands where they existed on 15 December 1971.

The 1971 WHBA was later amended by the Federal Land Policy and Management Act (FLPMA [P.L. 94-579]), and by the Public Rangelands Improvement Act of 1978 (PRIA [P.L. 95-514]). Dated 21 October 1976, the FLPMA governs most uses of the federal public lands, including grazing, and implemented a land use planning process that was based on multiple use and sustained yield principles. It further allowed for the use of helicopters and motorized vehicles for the purpose of managing of wild horses and burros on public lands. The PRIA was established in response to declining public rangeland productivity, brought about in part from increased grazing pressure of recovering wild horse and burro populations as well as domestic livestock. In addition to increased federal rangeland inventory analysis and management oversight, the PRIA also facilitated the ability of the federal government to remove excess numbers of horses and burros that pose a threat to themselves, their habitat, and/or other rangeland resources.

The need for the development and implementation of an effective WHBMP is identified in the CDCA Plan of 1980, as amended; EIS, Appendix XIII for the Proposed CDCA Plan; and the Memorandum of Understanding (MOU) between the BLM and NAWS-CL. Cooperative management efforts are needed since there is a regular interchange and movement of horses and burros not only between NAWS-CL lands and adjacent BLM lands, but also between U.S. National Park Service (Death Valley National Park) and National Training Center (NTC) Fort Irwin lands.

1.1.2 Current Regulatory Environment

The California Desert Protection Act of 1994 (CDPA [P.L. 103-433]) reauthorized the Navy's continued use of public withdrawn lands at the NAWS-CL until 2014, or until the next reauthorization legislation. Through the CDPA, and a subsequent Memorandum of Agreement, the Department of the Interior assigned management responsibility of these lands to the Navy. The CDPA further required the Navy's development of a land use management plan for these withdrawn lands in accordance with FLPMA. To meet with this requirement NAWS-CL has prepared a Comprehensive Land Use and Management Plan (CLUMP). The INRMP provides a comprehensive plan for management of natural resources and is the umbrella plan to this WHBMP.

The CDPA directed the Secretary of the Navy to assume responsibility for the management of wild horses and burros on the NAWS-CL in accordance with laws applicable to such management on public lands. The BLM to prepares and implements a comprehensive plan for the management of wild horses and burros on all public lands within the CDCA.

The 1997 amendments to the Sikes Act Improvement Act (SAIA) required military installations to "prepare and implement INRMPs that conserve and rehabilitate natural resources and, to the extent consistent with the military mission of the reservation, to provide for sustained multipurpose uses of those resources and to provide the public access necessary or appropriate for those uses." The WHBMP is an integral part of the NAWS-CL INRMP. Since horses and burros both utilize lands managed by the Navy and the BLM, and to facilitate compliance with the CDPA and SAIA requirements, this document recognizes the roles and responsibilities of both the Navy and the BLM to effectively collaborate in the management of these animals.

1.1.3 U.S. Navy-BLM Interagency Agreement

An Interagency Agreement dated May 2010 between Commander, Navy Region Southwest (CNRSW) and the BLM (CNRSW and BLM 2010) is predicated on the fact that "Herds of wild horses and burros graze on lands which are administered by BLM and NAWS-CL, which share common jurisdictional boundaries." The Agreement sets the tone for the two agencies to work together. The Centennial Herd uses lands administered by both agencies. The agencies cooperate in matters of joint responsibility such as conducting census, gathering excess animals, removing excess animals, planning and budgeting the cooperative activities. Continuation of this cooperation is essential to the successful management of the Herd. Should the BLM not be capable of accepting animals into their program the Navy may consider placement with other organizations or individuals capable of properly caring for excess animals.

1.2 MANAGEMENT CONSIDERATIONS

Years of intensive grazing by horses, burros, and cattle have resulted in impacts to NAWS-CL lands. These impacts are most noticeable in concentrated use areas such as at water sources and nearby uplands. Grazing by horses and burros is also considered a threat to management of federally listed species, such as the Inyo California towhee and the desert tortoise. Both of these animals have designated Critical Habitat on NAWS-CL. Finally, horses and burros pose a risk to NAWS-CL's abundant cultural resources that require protection.

Although the elimination of cattle grazing from the NAWS-CL in 2000 reduced these ongoing impacts, NAWS-CL has identified the need to further protect native species and to facilitate and monitor rangeland recovery. Maintenance of a healthy horse herd and implementation of measures to facilitate complete removal of burros has also been identified as a management priority. The cost-effectiveness of various management choices and the funding requirements that accompany management of herd numbers has been an on-going issue.

Current management direction for wild horses and burros within NAWS-CL is contained in a number of land use plans and reports that were developed as early as 1980. These plans lack updated information and do not adequately consider the most current management and strategy. This WHBMP incorporates appropriate elements of these other herd management plans. Other elements were derived from applicable current and available research and literature. This WHBMP also incorporates many management practices that have proven effective on NAWS-CL during the last 28 years of horse and burro management.

1.3 PLAN APPROACH

The purpose of this planning effort is to develop a WHBMP that will provide an overall direction and strategy for managing wild horse and burro populations on NAWS-CL lands for the future. The WHBMP will provide a practical framework that can be effectively implemented by the NAWS-CL Environmental Management Division (EMD). Plan implementation is best accomplished by continued collaboration with the BLM Ridgecrest Field Office and other nearby federal land managers.

2.0 BACKGROUND

2.1 EXISTING ENVIRONMENT

2.1.1 Physiography

NAWS-CL is located in portions of Inyo, Kern, and San Bernardino counties in the western Mojave Desert region of California, approximately 150 miles (241 kilometers [km]) northeast of Los Angeles. NAWS-CL comprises an area of approximately 1.1 million acres (445,154 hectares [ha]) and is primarily located within two physiographic provinces: the Great Basin Province and Mojave Desert Province. The land ranges at NAWS-CL are remote and consist of a diversity of land systems characterized by rugged block-faulted mountain ranges separated by alluvium-filled basins mostly of internal or closed drainage. The basins consist of broad valley plains, gentle sloping bajadas, and rolling hills with low relief. The lowest basins form floors of ephemeral lakes (playas), with either clay or saline beds. The eroding mountains produce talus slopes, boulder fields, and rocky or gravelly alluvial fans that merge into the sandy soils and fine gravels of bajadas and plains. Although none of the basins presently contain permanent surface water, groundwater exists at relatively shallow depths. Major physiographic features within and proximal to NAWS-CL are illustrated in Figure 2.1-1.

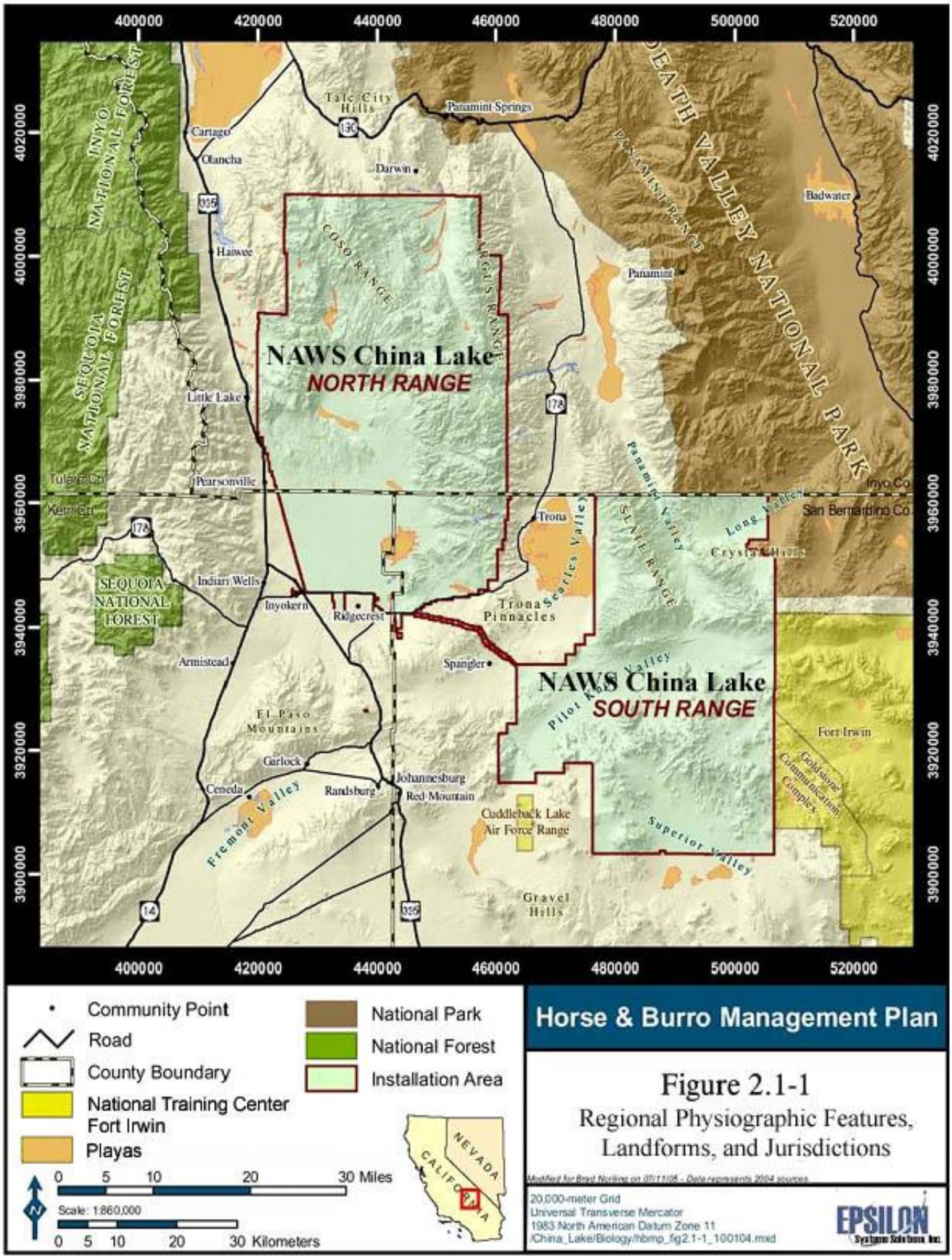
2.1.2 Soils

Soils within NAWS-CL and the surrounding region have developed and are distributed according to differences in parent material, elevation, deposition processes, and topographic slope and position. The coarsest depositional materials derived from mountainous parent rock are generally found on upper regions of high plains and slopes, while the finest materials are along valley floors. Soils of upper bajadas consist of coarse gravels grading into loamy gravels toward the toe of alluvial fans. Soils of lower bajadas, grade from sandy loams to finer loamy materials. Playas located at the bottom of basins accumulate silts and clays and generally develop salt pannes. Higher mountain soils in NAWS-CL are excessively drained, very stony or rocky, sandy loams to sands that are derived from nearby parent material.

2.1.3 Water Resources

Surface water resources within NAWS-CL and the vicinity are scarce. Steep washes descending from mountains and other elevated landforms provide intermittent channels that route surface runoff into topographical depressions or playas where temporary or ephemeral lakes are formed. Water accumulates in these areas during times of greater than average precipitation, which can be expected to occur on average of every two or three years.

Most streams and large areas of standing water are intermittent (occurring on a regular though highly seasonal basis) to ephemeral (occurring only during and immediately after heavy rains or thunderstorms). When surface flow due to high intensity rainfall occurs, the water quickly percolates into the sandy soil of dry washes or collects on a number of playas within and adjacent to NAWS-CL. The only naturally occurring surface water resources within NAWS-CL are a series of over 120 known springs or seeps. There are 85 of these springs on the North Range, the majority of which are located in the Argus and Coso Ranges (Figure 2.1-2). These springs range in size from diminutive areas of imperceptible seepage to relatively large areas supporting riparian vegetation with flows approaching six gallons (23 liters) per minute (Glenn Lukos Associates 1998). Almost all springs have a perennial flow, and very few dry up during summer months.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SOUTH RANGE
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SEQUOIA NATIONAL FOREST
SEQUOIA NATIONAL FOREST
COSO RANGE
ARGUS RANGE
PANAMINT RANGE
SLATE RANGE
Talc City Hills
Panamint Springs
Cartago
Olancha
Darwin
Badwater
Haiwee
Panamint
Little Lake
Pearsonville
Tulare Co
Kern Co
Inyo Co
San Bernardino Co
Trona
Trona Pinnacles
Searles Valley
Panamint Valley
Long Valley
Crystal Hills
Indian Wells
Inyokern
Ridgecrest
Armistead
Spangler
Pilot Knob Valley
El Paso Mountains
Garlock
Cantil
Randsburg
Johannesburg
Red Mountain
Cuddleback Lake Air Force Range
Fremont Valley
Superior Valley
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National Forest
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NEVADA
CALIFORNIA
Horse & Burro Management Plan
Figure 2.1-1
Regional Physiographic Features, Landforms, and Jurisdictions
Modified for Brad Nortiss on 07/11/05 - Data represents 2004 sources
20,000-meter Grid
Universal Transverse Mercator
1983 North American Datum Zone 11
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Most of these springs were developed by miners and ranchers prior to the Navy assuming their management (U.S. Navy 2002). A few of the springs are currently maintained by the Navy for remote facility use or were maintained by past cattle grazing leases in the Argus, Coso, Eagle Crags Mountain, and Pilot Knob Areas. For example, the spring at Stone Corral is maintained and used for off-site, non-potable purposes. There are 42 known springs or seeps on the South Range (Figure 2.1-2). A few of these springs have been developed as water sources for wildlife.

Many of these springs and nearby upland areas support a high diversity of plant and animal species and significant areas of riparian vegetation. The protection and enhancement of surface and groundwater resources continues to be a major focus of natural resource management effort by the EMD on NAWS-CL. Although several of these water resources have been protected by fencing or paneling, some continue to be severely impacted by feral horses and burros (U.S. Navy 2002). Certain springs are especially important with respect to habitat for the federally listed Inyo California towhee *(Pipilio crissalis eremophilus)* in the southern Argus Range.

2.1.4 Climate

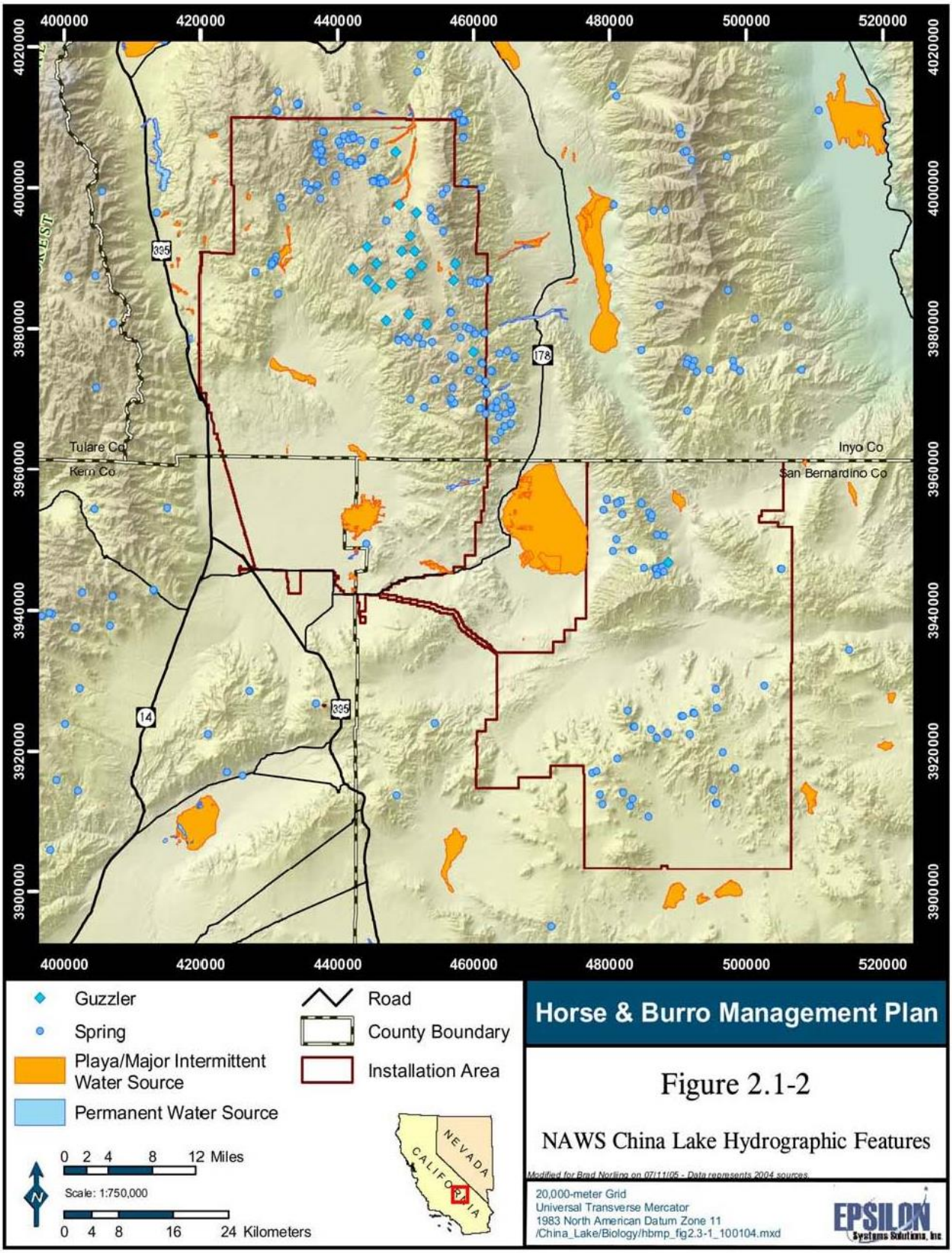
The climate of NAWS-CL is characterized by dry air masses, high summer temperatures, infrequent precipitation, extremely high evaporation rates, and large diurnal temperature changes. Temperatures also vary with elevation, and to a lesser extent, local microclimate.

Annual weather data from nine weather stations in the vicinity of NAWS-CL show that rainfall varies greatly by elevation and among years. Precipitation averages about four inches at lower elevations (Figure 2.1-3) (<3,000 feet), 6.2 inches at middle elevations (300-4,500 feet), up to 9.3 inches at higher elevations (6,800 feet), with about 20-22 days per year of measurable precipitation. It snows an average of two to three days per year at the lower elevations (data not available for higher elevations). Most of the rain falls in the winter and early spring, with thunderstorms occurring primarily during August and September.

2.1.5 Vegetation

NAWS-CL is located in a transition zone between the Basin and Range and Mojave Desert regions of the Great Basin Floristic Province (Hickman 1993). This region supports an array of geographic substrates, topographic features, climatic regimes, soil types, and other physical factors, which have combined to produce a mosaic of floristic components and associated natural habitats. The plant communities encountered on NAWS-CL consist of typical Mojave Desert or Basin and Range associations. These communities are often mixed, transitional, or widely distributed. Also present is a southern Sierra Nevada Mountains vegetation component on the North Range. The plant communities and their distributions are depicted in Figures 2.1-4 and 2.1-5.

Throughout many of these plant communities, small riparian and wetland areas occur in association with springs and seeps. Rushes, sedges, forbs and deciduous trees that are uncommon elsewhere are found at many of these sites. An increased diversity of large ungulates, small mammals, birds, reptiles and amphibians use these areas for water, shade, succulent forage, and important trace minerals. Although the locations of these areas are documented, most are too small to be adequately represented on a vegetation map at the scale shown in Figures 2.1-4 and 2.1-5.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Kern Co
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San Bernardino Co
Guzzler
Spring
Playa/Major Intermittent Water Source
Permanent Water Source
Road
County Boundary
Installation Area
0 2 4 8 12 Miles
Scale: 1:750,000
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NEVADA
CALIFORNIA
Horse & Burro Management Plan
Figure 2.1-2
NAWS China Lake Hydrographic Features
Modified for Brad Norling on 07/11/05 - Data represents 2004 sources.
20,000-meter Grid
Universal Transverse Mercator
1983 North American Datum Zone 11
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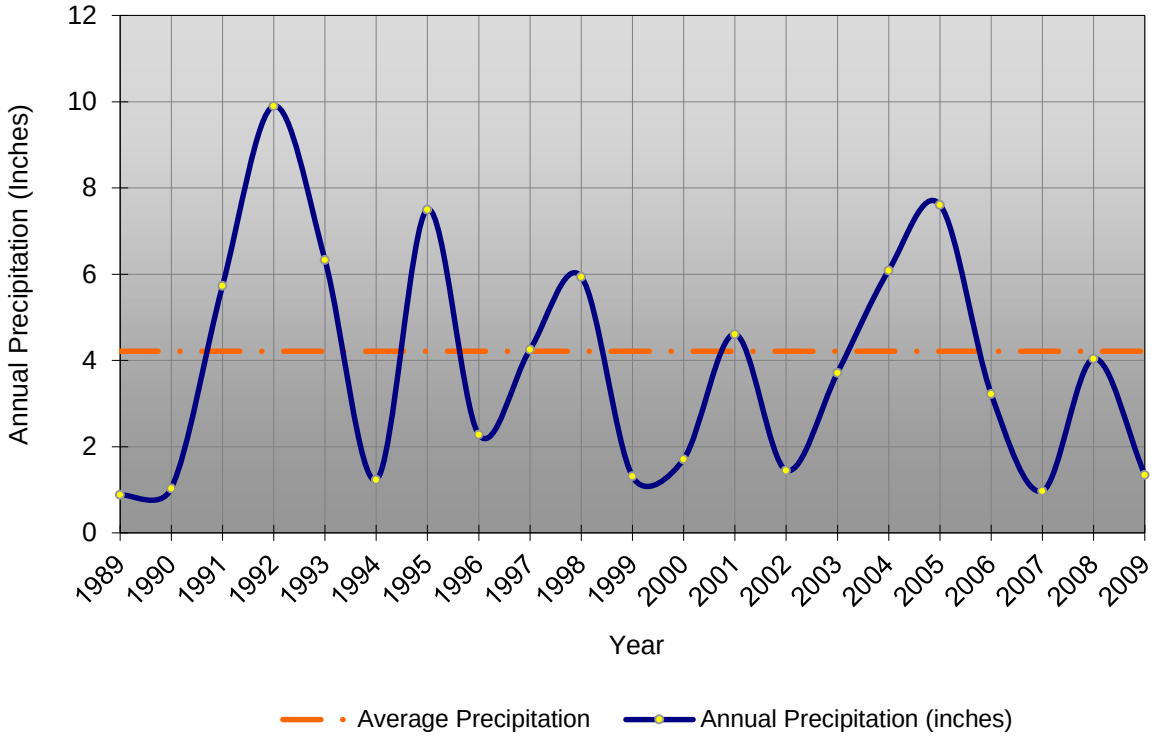
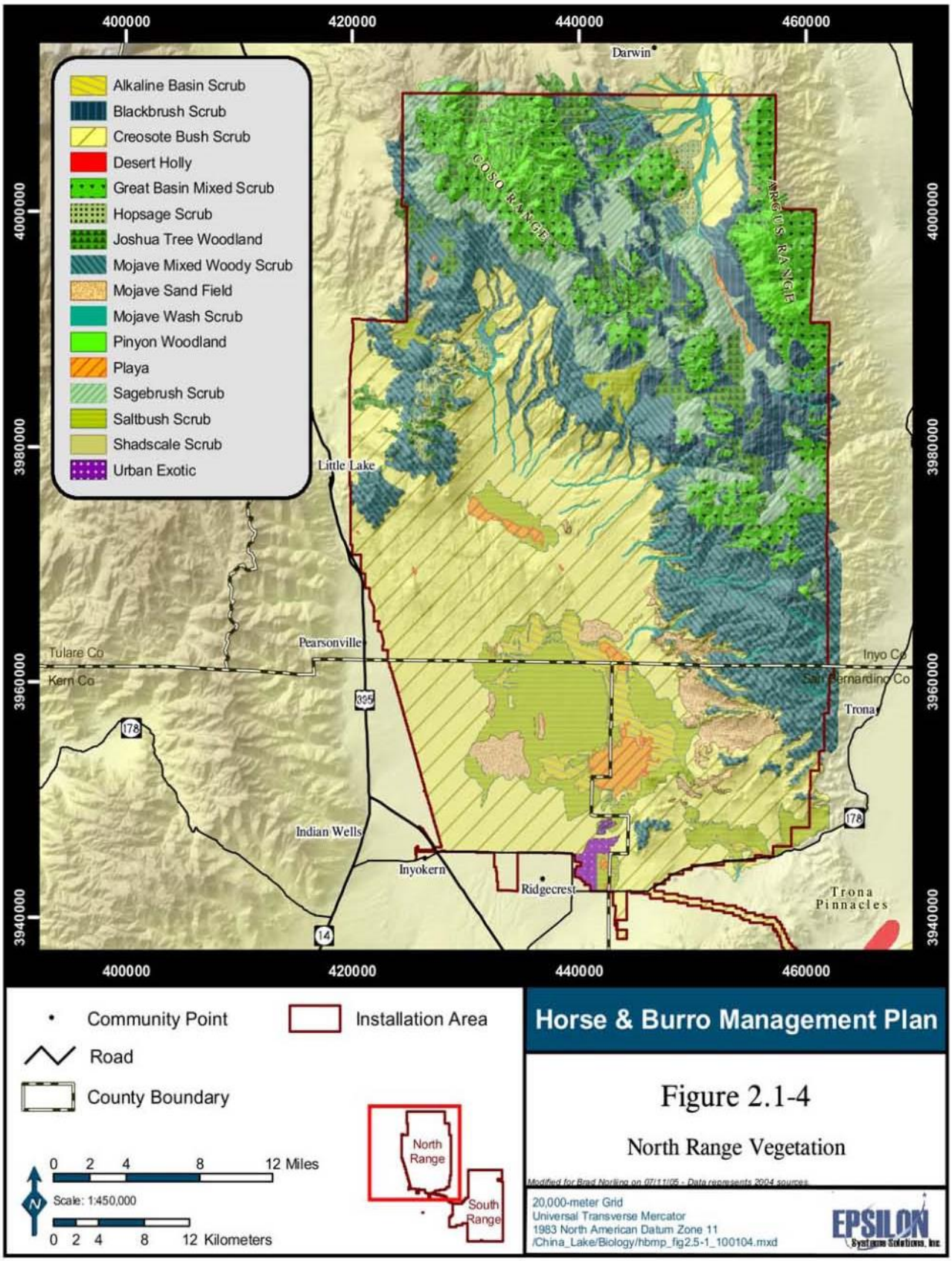


Figure 2.1-3. Comparison of Twenty Year (1989-2009) Annual Precipitation Totals (solid blue line) with Average annual Precipitation (dashed red line) the NAWS-CL.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Blackbrush Scrub
Creosote Bush Scrub
Desert Holly
Great Basin Mixed Scrub
Hopsage Scrub
Joshua Tree Woodland
Mojave Mixed Woody Scrub
Mojave Sand Field
Mojave Wash Scrub
Pinyon Woodland
Playa
Sagebrush Scrub
Saltbush Scrub
Shadscale Scrub
Urban Exotic
Darwin
COSO RANGE
ARGUS RANGE
Little Lake
Pearsonville
Tulare Co
Kern Co
Inyo Co
San Bernardino Co
Trona
395
178
Indian Wells
Inyokern
Ridgecrest
Trona Pinnacles
14
Community Point
Road
County Boundary
Installation Area
0 2 4 8 12 Miles
Scale: 1:450,000
0 2 4 8 12 Kilometers
North Range
South Range
Horse & Burro Management Plan
Figure 2.1-4
North Range Vegetation
Modified for Brad Norling on 07/11/05 - Data represents 2004 sources
20,000-meter Grid
Universal Transverse Mercator
1983 North American Datum Zone 11
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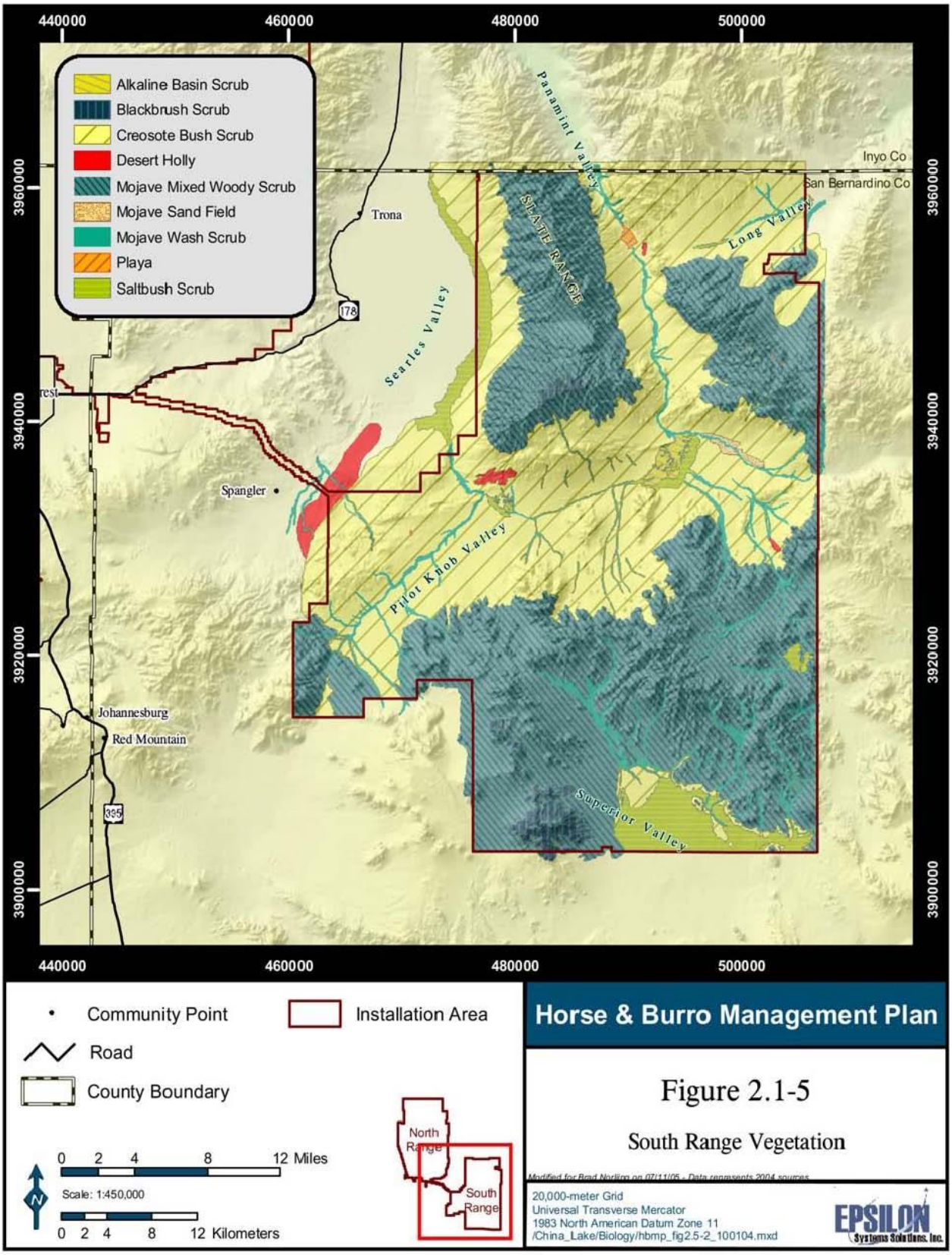
Systems Solutions, Inc.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Alkaline Basin Scrub
Blackbrush Scrub
Creosote Bush Scrub
Desert Holly
Mojave Mixed Woody Scrub
Mojave Sand Field
Mojave Wash Scrub
Playa
Saltbush Scrub
Panamint Valley
Inyo Co
San Bernardino Co
Trona
SLATE RANGE
Long Valley
Searles Valley
178
Spangler
Pilot Knob Valley
Johannesburg
Red Mountain
395
Superior Valley
Community Point
Installation Area
Road
County Boundary
0 2 4 8 12 Miles
Scale: 1:450,000
0 2 4 8 12 Kilometers
North Range
South Range
Horse & Burro Management Plan
Figure 2.1-5
South Range Vegetation
Modified for Brad Norling on 07/11/05 - Data represents 2004 sources
20,000-meter Grid
Universal Transverse Mercator
1983 North American Datum Zone 11
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EPSILON
Systems Solutions, Inc.

2.1.6 Wildlife

NAWS-CL supports nearly 400 species of wildlife, including big game animals, upland game birds, lagomorphs, rodents, reptiles, amphibians, and a variety of neotropical bird species. Mule deer (*Odocoileus hemionus inyoensis*) and bighorn sheep (*Ovis canadensis nelsonii*) have overlapping requirements for food sources, water resources and space with wild horses and burros. Portions of NAWS-CL provide year-long rangelands for both mule deer and bighorn sheep.

Wetland and riparian habitat communities in NAWS-CL support the greatest diversity and density of fauna. These areas are important to the federally listed Inyo California towhee as well as a number of other sensitive species, migratory birds and herptofauna. The competition between wild horses and burros and many of these species is intensified by the tendency of the former to congregate in such areas. In addition, burros are known to compete with several NAWS-CL sensitive species for grasses and forbs, including the state-listed Mojave ground squirrel (*Spermophilus mojavensis*) and the federally listed desert tortoise (*Gopherus agassizii*). Figure 2.1-6 shows the Critical Habitat areas on NAWS-CL for the Inyo California towhee and regional Critical Habitat areas for desert tortoise.

2.2 GRAZING

2.2.1 History of Grazing on the NAWS-CL

Lands within NAWS-CL and the surrounding region have been grazed since the mid-1800s by both cattle and sheep. In 1934, the Taylor Grazing Act (TGA) was passed and the area became part of the first grazing district in California. The TGA was administered by the Grazing Service (now the BLM) and was responsible for the establishment of allotment boundaries, allocation of grazing use (number of animal unit months), and controls on season of use.

In 1943, the Naval Ordnance Test Station (now NAWS-CL) was established and included parts of six active grazing allotments comprising approximately 92,300 acres (37,353 ha) of Navy lands (Figure 2.2-1). These included the Tunawee Common, Cactus Flat, McCloud Flat, Darwin, and Lacey allotments in the North Range, and Pilot Knob and Superior allotments in the South Range.

In 1945, Stock Operators Agreements were completed between the Navy and the ranchers allowing continuation of existing (Grazing Service) grazing leases on NAWS-CL lands. In 1959, a MOU was created between the NAWS-CL and BLM, whereby BLM would be responsible for overall rangeland improvements and rehabilitation, and the administration of grazing including the monitoring of rangeland condition and the balance of appropriate livestock numbers with forage production. Three of the original six allotments within NAWS-CL were considered active within the past 25 years.

The Pilot Knob and Superior Valley allotments were the only livestock allotments on the South Range. These allotments had been grazed for over 100 years by cattle and to a lesser extent by sheep. Originally the ranch headquarters (PK Ranch) and parts of the allotment were on NAWS-CL lands. Grazing was ultimately eliminated from the NAWS-CL portion of this allotment in 1982, reducing the total acreage of this allotment from 97,920 to 48,000 acres (39,627 to 19,425 ha) after the gunnery range in Superior Valley was established. Trespass grazing still occurred on NAWS-CL lands until a fence was constructed in 1991.

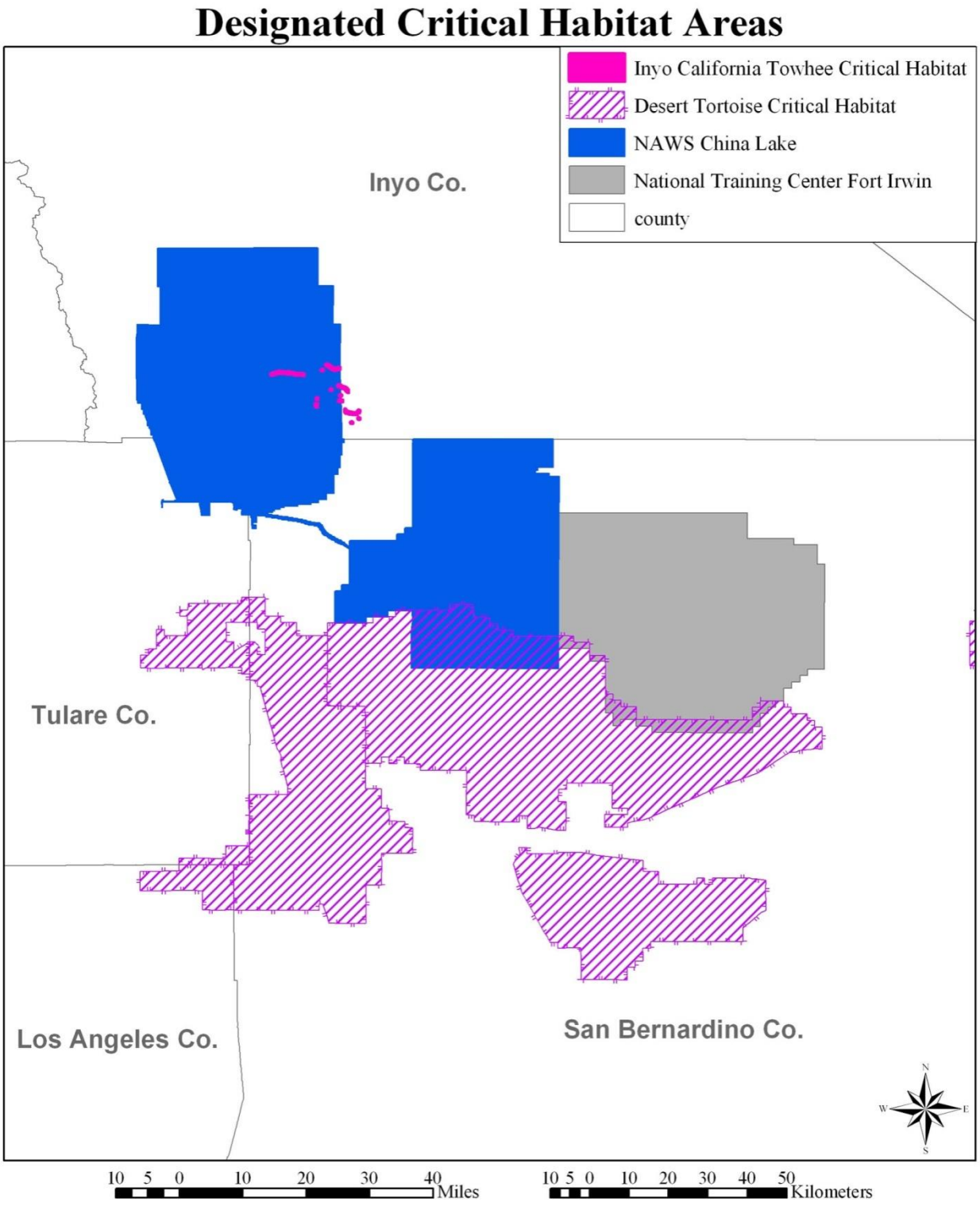
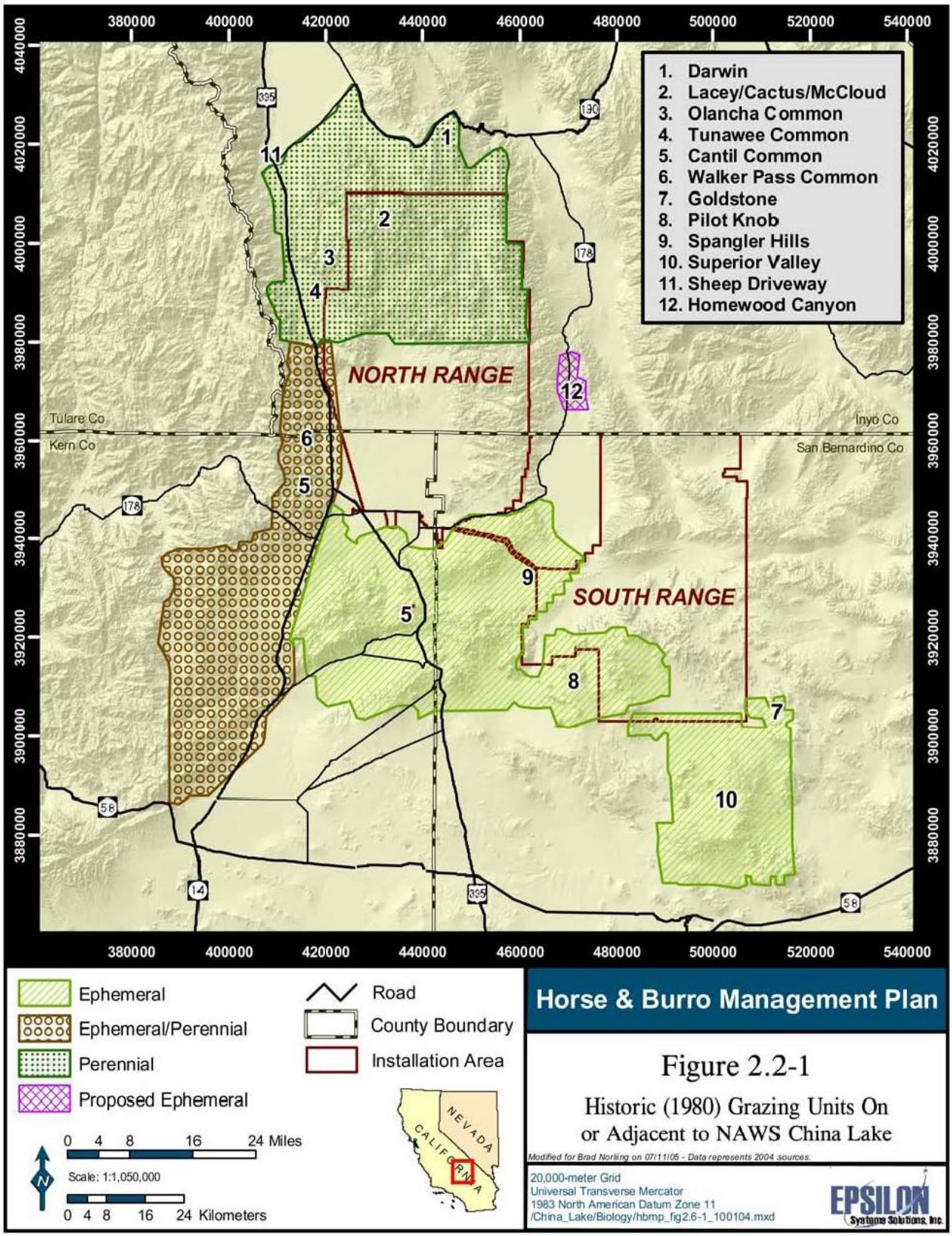


Figure 2.1-6 Designated Critical Habitat areas for the Inyo California towhee and the desert tortoise on NAWS China Lake.


1. Darwin
2. Lacey/Cactus/McCloud
3. Olancha Common
4. Tunawee Common
5. Cantil Common
6. Walker Pass Common
7. Goldstone
8. Pilot Knob
9. Spangler Hills
10. Superior Valley
11. Sheep Driveway
12. Homewood Canyon
NORTH RANGE
SOUTH RANGE
Tulare Co
Kern Co
Inyo Co
San Bernardino Co
380000
400000
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440000
460000
480000
500000
520000
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4020000
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3980000
3960000
3940000
3920000
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3880000
Ephemeral
Ephemeral/Perennial
Perennial
Proposed Ephemeral
Road
County Boundary
Installation Area
0 4 8 16 24 Miles
Scale: 1:1,050,000
0 4 8 16 24 Kilometers
NEVADA
CALIFORNIA
Horse & Burro Management Plan
Figure 2.2-1
Historic (1980) Grazing Units On or Adjacent to NAWS China Lake
Modified for Brad Norling on 07/11/05 - Data represents 2004 sources.
20,000-meter Grid
Universal Transverse Mercator
1983 North American Datum Zone 11
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EPSILON Systems Solutions, Inc.

The Tunawee Common allotment included about 13,500 acres (5,463 ha) on the North Range of NAWS-CL near the Coso Known Geothermal Resource Area on which grazing was permitted for only 1.5 months annually. It was originally a sheep allotment but was converted to a cattle allotment in 1985.

In 1968, the Lacey, Cactus Flat, and McCloud Flat allotments were combined into one allotment, known as the Lacey-Cactus-McCloud (LCM) allotment, as a result of the Cabin Bar Ranch's purchase of the John Lacey rights (BLM 1984). The LCM grazing allotment encompassed the northern third of the North Range and nearby BLM-managed land to the north and west. In 1981, a MOU signed by NAWS-CL, BLM, and the Cabin Bar Ranch suspended cattle grazing on NAWS-CL during burro reduction efforts. Grazing on the LCM allotment resumed again in 1982 and continued under the Allotment Management Plan until 1998.

Grazing in the LCM continued from 1998 to June 2000 under a two-year interim permit issued by the BLM. During the period of the interim permit, NAWS-CL evaluated the cattle-grazing program to determine if management adjustments were needed to ensure the program complied with applicable environmental requirements and was still compatible with NAWS-CL's mission. As a result of this evaluation, the NAWS-CL Commanding Officer determined that cattle grazing was not compatible with the Station's mission and could no longer be accommodated. Formal notification of the NAWS-CL decision was provided to the BLM Area Manager in April 2000, and cattle grazing activities were officially terminated on NAWS-CL lands in the fall of 2000.

2.2.2 Rangeland Condition and Trend

While the impacts to spring and riparian habitat from excessive grazing by domestic livestock and feral equids is well documented (BLM 1995; U.S. Navy 1980, 1981, 1999, 2002; Platts 1984), there is little information available on the impacts to upland vegetation from overgrazing within NAWS-CL. Available information is anecdotal, and suggests that overgrazing and downward trend in rangeland condition were apparent on the North and South Ranges of NAWS-CL as early as the 1970s. For example, in 1973, a BLM rangeland specialist noted that nearly all the perennial grass cover had been eliminated from the Coso Grazing Unit. Overgrazing in this unit was evident throughout usable rangeland areas and was found to be as severe in areas used largely by feral burros as in those areas used by all three classes of grazing animals (cattle, horses, and burros). Areas near water were most heavily grazed. An estimated 500 head of cattle were run in the Coso area during this period (Ouimette 1974). In addition, rangeland condition for the Pilot Knob Allotment in the South Range was reported to be extremely variable, tending to be poor due to drought and overgrazing by livestock and feral burros. In 1984, the BLM rated the North Range of NAWS-CL in fair condition, although the areas around water sources were rated as poor. The latter had partial to complete removal of desirable vegetation, reduction or removal of total plant cover, compaction of soils, and overall increased rates of erosion (BLM 1984).

The most recent analysis of rangeland condition within NAWS-CL was presented by the BLM in a grazing evaluation study of the LCM Allotment for the period of 1986-1995 (BLM 1995). This evaluation, based on 20 vegetation monitoring sites, showed a downward trend, indicating a history of over-utilization by ungulates, including cattle. The over-utilization was attributed to a combination of factors including sustained drought, improper distribution of cattle, and use by cattle and wild horses above the proper use level. Although the report does not single out any one factor over the other in causing the overall downward trend in this allotment, a closer examination of the monitoring data suggests that wild horses may have played a greater role in the downward trend than previously attributed to cattle. For example, data from the

1986-1995 studies indicate utilization by cattle near or below the livestock allocation preference of 3,136 Animal Unit Months (AUMs) (Figure 2.2-2). In the period from 1987-1995, actual use by cattle averaged 1,670 AUMs (53% of preference). In contrast, actual use by wild horses was consistently above the 2,475 AUMs allocated with an average of 5,988 AUMs or 297 percent above appropriate management levels (AML) (Figure 2.2-1) (BLM 1995).

2.3 WILD HORSE AND BURRO ECOLOGY

2.3.1 Horses

Wild horses use portions of NAWS-CL and surrounding BLM lands on a year-long basis. The horses in the area of the Argus Range are generally located in the blackbrush scrub and Joshua tree zone where they may graze on remnants of bunch grasses and other vegetation on the lava mesas. In the Coso Mountains during the spring and summer months, horses generally stay in the higher elevation areas and will often move down to lower elevation areas in the winter. While it is possible to see a few horses in lower elevations during any time of the year, the majority of the bands are rarely seen below 2,600 feet (792 meters [m]).

2.3.1.1 Dietary Requirements

Horses are primarily grazers and are typically highly selective with respect to forage species. Under ordinary rangeland conditions, 80 to 95 percent of their diet consists of grasses and grass-like plants. They will actively consume the short new growth of these species, but will closely crop more woody vegetation when preferred species are scarce. If the availability of preferred species is limited, horses may utilize a variety of browse, including saltbush (*Atriplex* spp.), rabbitbrush (*Chrysothamnus* spp.), sagebrush (*Artemisia* spp.), greasewood (*Sarcobatus vermiculatus*), and mountain mahogany (*Cercoparpus* spp.) (Hanson and Clark 1977).

The average daily consumption of forage for a mature horse is estimated to be approximately 17 pounds (7.7 kilograms [kg]) dry weight per day (National Research Council, 1978). Forage intake for yearlings and foals is estimated at approximately 17 pounds (7.6 kg) and 9 pounds (4.1 kg) dry weight per day, respectively, while forage requirements for lactating mares is substantially higher at an estimated 25 lbs. (11.4 kg) dry weight per day (National Research Council 1978).

Over most of their rangeland, horses are usually found within two to five miles (3.2 to 8.0 km) of water and very rarely occur more than ten miles (16.1 km) from water. They will typically visit water holes at least daily, most frequently in late afternoon. An adult wild horse normally consumes from ten to 20 gallons (37.9 to 75.7 liters) of water per day depending on the ambient temperature and the animal's activity level (BLM 2003a). Horses typically spend less time feeding and more time drinking and resting during successively warmer months.

Figure 2.2-2. Comparison between Actual Use (solid line) and Allocated AUMs (dashed line) for Cattle and Wild Horses on the LCM Allotment (BLM 1995).

2.3.1.2 Social Organization

Wild horses have complex social behaviors, and although some individuals are solitary, most are found in discrete bands. They are generally not territorial and do not defend specific grazing areas or watering sites (Berger 1977). Social organization involves formation of both harem bands and bachelor bands. The mating system is polygamous and relatively few males in a population breed. Mixed bands or harems usually consist of a stallion and four to six mares and their young. Mares are less aggressive than males and form complex associations with other mares in the band, establishing dominance hierarchies within the harem. Adult mares in a harem rarely stray more than 1,000 feet (300 m) from other members of the harem (Ryden 1970). When foaling, females move away from the herd, sometimes accompanied by non-pregnant mares. As young males reach one to three years of age, they are forcibly expelled from the group by the dominant stallion and form small bachelor bands led by a young dominant stallion. When stallions are older and strong enough to commandeer a harem of their own, they may leave the bachelor group (Dobie 1952; Ryden 1970; Tyler 1972).

Adolescent females are usually incorporated into harem groups when they are two to three years of age, by mature males seeking to establish or add to their harem. In some instances, mature mares may forcibly expel adolescent females from the harem. Stallions often do not protect adolescent females from raids by other stallions (Dobbie 1952; Tyler 1972).

2.3.1.3 Reproduction

A composite of various parameters of horse reproduction based on data from a number of studies is presented in Table 2.3-1 as summarized by Kirkpatrick and Turner (1986). Perhaps the most significant finding is the wide range of values for most measures. It is anticipated that NAWS-CL horses fall within these value ranges.

In temperate North America, mares generally foal between April and June. The average gestation period is about 340 days. Postpartum estrus usually occurs seven to ten days after foaling (Berger 1986). Reproductive success for wild horses is highly variable from year to year and possibly within a herd area. Foaling rates can vary from 20 to 40 foals per 100 mares, up to a 65 percent annual foaling rate for a population in Montana (Garrot and Taylor 1990). There may also be considerable differences in the pregnancy rates among different age groups (Kirkpatrick and Turner 1986). Mares may become sexually active as early as two years of age, but mares from the age of four to 15 years old generally have the highest reproductive rates. The average annual rate of population increase for wild horses is near 14 percent, with a range of 11 to 20 percent. This rate of increase will produce population doubling about every four to seven years.

Table 2.3-1. Population Parameters for Various Wild Horse Herds in Montana, Idaho, Oregon, Nevada, and Wyoming from 1970-1983.

PARAMETER	RANGE
Annual Population Increase	11-20%
Rate of Pregnancy	35-85%
Foaling Rate	20-65%
Sex Ratio M/F	0.91-1.06 M/F
Lifespan (years)	18-25 Years of Age
Functional Age of Reproduction	2-21 Years of Age
Band Size	3-24 Individuals

Source: (Kirkpatrick and Turner 1986)

2.3.1.4 Mortality

Mortality in horses is typically associated with severe winter weather starvation, and disease. Survival rates of wild horses are reported to be very high exceeding 95 and 97 percent for herds in Nevada and Montana, respectively (Berger 1986; Garrott and Taylor 1990). Survival rates of wild horses on NAWS-CL are unknown but may be lower during prolonged drought periods, which may limit forage production and water availability. Few animals prey on wild horses, although mountain lions have been known to take some foals in some localities. The lifespan of wild horses has been found to be from 18-25 years, with only a small number of horses, usually lone males, reaching 25.

2.3.2 Burros

Feral burros can be found in the Coso and Argus Ranges on the North Range and the Eagle Crags, Slate, and Brown Mountains on the South Range. Their movements and distribution are generally temperature related. During the summer months, burros may become somewhat solitary and will often retreat to the higher elevations and canyons with reliable sources of water. In the late fall, burros may move down to lower elevation alluvial fans and valleys throughout the creosote bush scrub and Mojave mixed woody scrub zones. During periods of moderate to heavy rainfall, and particularly during the springtime green-up, they will disperse many miles from perennial water sources looking for green vegetation. They also frequent the low elevation areas around the China Lake playa in winter and spring, and occasionally into summer.

2.3.2.1 Dietary Requirements

Burros are primarily browsers, but feed on nearly all available desert vegetation. In a study of a wild burro population in Arizona, Seegmiller and Ohmart (1981) found the diet to include 23 percent grasses and sedges, 34 percent forbs, and 43 percent shrubs. Ruffner and Carothers (1982) reported similar forage preferences for burros in the Lower Canyon of Grand Canyon National Park, where their diet included 30 percent grasses, 14 percent forbs, and 56 percent shrubs. They will actively consume the short new growth of these species but will closely crop vegetation to the soil level and dig the roots from the ground with their hooves when available forage is scarce. Due to differences in digestive system anatomy, burros are capable of eating larger quantities of high fiber plants. When compared to ruminants such as deer, bighorn sheep, and cattle, burros are at a decided advantage when overgrazed conditions are present. Because of their ability and need to consume large quantities of vegetation, more damage to preferred species is realized in overgrazed areas from burros.

The average daily consumption of forage for a burro is estimated to be approximately 9.9 pounds (4.5 kg) dry weight per day (Douglas and Hurst 1993). They are usually found foraging for food during daytime, except during summers, when they often will forage at night and in the early morning. Although some moisture is provided in the plant materials they consume, burros must have drinking water throughout the year. Burros can tolerate a water loss of 30 percent of their body weight, and replenish it in only five minutes drinking. Over most of their range, burros are usually found within ten miles (16.1 km) of water and will typically visit water holes at least daily, most frequently in late afternoon. An adult burro drinks an average of five gallons (22 liters) of water per day depending on the ambient temperature and the animal's activity level (Douglas and Hurst 1993).

2.3.2.2 Social Organization

Burros are generally considered more solitary than horses, but will often form small bands comprised of jennies and their offspring. Some individuals, almost always males, live alone, but most are found in unstable groups of variable composition (Nowak 1999). There is no indication of permanent bonds between adults other than sexual relationships. Groups vary considerably in their composition, breaking up and reforming on an almost daily basis (Klingel 1972). Herds may comprise as many as 50 animals (Nowak 1999). Smaller herds have individuals of only one sex or a single jack with a few females, whereas larger groups contain a number of adults of both sexes.

Burros are thought to be more territorial than horses. Some males may establish and defend large breeding territories where they mate with females that live in or pass through their area (Nowak 1999). Home range size of burros varies considerably depending on a number of factors including season, age, sex, geographic location, and population density. Territories range in size from two to 22 square miles (five to 70 square kilometers [km^2]) with an average of 8.9 square miles (23 km^2) (Hopkins 2001).

2.3.2.3 Reproduction

Mating in burros may occur year-long, but generally peaks from May through July. The gestation period is usually 12 months and the young are weaned from the mother at about five months of age (Moehlman 1974). Females reach sexual maturity at two years of age and can give birth to one foal each year after that. Males may reach sexual maturity as early as two years old but are more likely to become dominant enough to control mating at three to four years old (Strahan 1983). Reproductive success for wild burros is variable from year to year and among areas within their range. China Lake burros are known to have a remarkably high reproductive potential. Data from the first comprehensive study conducted on NAWS-CL indicated that nearly 20 percent of the population was under one year of age and that the pregnancy rate was almost 60 percent with over 11 percent of females lactating, which is an indication that they have recently given birth (U.S. Navy 1981). Burro populations can increase at rates ranging from 11 to 29 percent per year (Douglas and Hurst 1993; Mogart and Ohmart 1976). This rate of increase will produce population doubling about every five years.

2.3.2.4 Mortality

Mortality in burros is associated mostly with severe dehydration, starvation, and disease. Since burros have few natural predators, competitors, or common diseases, most young animals survive to maturity and may live as long as 25 years in the wild. First-year survival of burros ranges between 66 percent (Moehlman 1974) and 79 percent (Mogart 1978). Few animals prey on burros, although mountain lions have been known to take some adults and foals in some localities.

2.4 IMPACTS OF WILD HORSES AND BURROS

2.4.1 Environmental Impacts

Information regarding grazing impacts to vegetation and related degradation processes caused by large ungulates (domestic livestock and feral equids) is presented in general terms as both may cause similar impacts in upland and riparian areas. Although there have been few studies that quantify the specific impact that wild horses and burros have on the environment – as selective grazers of grasses and forbs – it can be expected that they would impact the environment in much the same way as domestic livestock.

2.4.1.1 Grazing in Arid Western Ecosystems

Like other ecological communities, desert communities are structured through proximate, historic, and evolutionary constraints that modify population dynamics of individual species, and potentially shape the interactions among species (Polis 1991). Desert plant associations are influenced by environmental factors such as the timing and amount of rainfall, length of growing season, and ambient temperature. Unlike many other ecological communities, however, desert communities have generally evolved in the absence of large mammalian herbivores. Desert communities of the southwest have not supported herds of large grazing herbivores since the Pleistocene Epoch, 10,000 years ago. The National Academy of Sciences concluded that wild horses and burros are exotic animals and are not in equilibrium with the environment. They further state that, "ecological niches to which Pleistocene equids related do not exist today, and no other animals in the contemporary North American fauna would have the same niche relationship as the modern-day equids, with or without the latter's presence" (National Research Council 1982).

Arid regions of the Southwest, such as NAWS-CL, are particularly fragile and susceptible to damage from grazing by both livestock and feral equids. Many ecologists generally agree that drier lands are most at risk of losing biological diversity to grazing, and that the more arid the climate, the more likely and more severe are the ecological impacts of grazing by introduced ungulates (Donahue 1999).

2.4.1.2 Impacts to Riparian Areas

Impacts to water sources and associated riparian habitats as a result of both domestic livestock and horse and burro grazing have been identified at numerous sites on the North and South Ranges (Pratt, personal communication [*pers. comm.*]). Removal of commercial cattle grazing from NAWS-CL in 2000 is expected to reduce environmental degradation over the long-term. However, wild horse and burro grazing has continued to affect natural and cultural resources in areas of the Coso, Argus, Slate, and Eagle Crags mountain ranges (U.S. Navy 2002). Similar effects have been reported for riparian habitats at a number of springs on NTC Fort Irwin, where burro trails and loafing areas have caused significant impacts to surrounding surface terrain and vegetation in these areas (Tiller 1997).

Feral equines, particularly burros, can have a dramatic impact on fragile arid land riparian areas. Documentation shows that burros, given the opportunity, will spend a disproportionate amount of time in a riparian area as compared to drier upland areas. Features that contribute to higher use levels in riparian areas are:

- Higher forage volume and relative palatability in the riparian areas as opposed to uplands
- Distance to water
- Distance upslope to upland grazing sites
- Microclimatic features

Burros concentrate activity around water sources primarily during summer, and as populations of these animals increase, damage to water sources and adjacent vegetation becomes more severe (U.S. Navy 1980). Phillips, Brandt, and Reddick (1981) indicated that burro grazing and trampling resulted in reduced herbaceous cover, biomass, and productivity, resulting in lower species diversity of native animals and plants.

Excessive grazing in riparian areas may also change the form and structural complexity of vegetation, as well as alter soil surfaces both physically and chemically. As in upland vegetation communities, where trampling in riparian areas compacts soil. That in turn reduces infiltration rates. Riparian soils are moist and are more prone to compaction (Bohn and Buckhouse 1985). Soil compaction can interfere with the water storage function of riparian areas (Lowrance *et al*. 1985).

2.4.1.3 Impacts to Upland Areas

Away from riparian areas, wild horses and burros can often damage native plants and the soil in which they germinate and take root. In a review of a number of studies of arid grasslands throughout the west, Jones (2000) reported that grazed areas averaged 80 percent more soil erosion, 24 percent less biomass, and 45 percent less biological soil crust coverage than comparable un-grazed areas. Biological soil crusts contain algae, lichens, mosses and microbes that reduce erosion, enhance water infiltration, and fix nitrogen. Other scientific studies found these valuable soil crusts are reduced significantly in grazed areas (Beymer and Klopatek 1992; Brotherson *et al*. 1983; Brotherson and Rushforth 1983).

Natural cryptobiotic soil crusts also inhibit exotic-plant germination, but grazing from large ungulates such as feral horses and burros can break up these crusts (Kaltenecker and Wicklow-Howard 1999; Eckert *et al*. 1986; Mack 1989; Rosentreter 1994). Excessive grazing by these animals can also create bare ground and facilitate weed invasions. Consumption of forage containing seeds of exotic weeds and other plants can, in turn, lead to their introduction and spread into other areas. Numerous studies have found higher concentrations of exotic plants in grazed areas than on comparable ungrazed lands throughout the west (Daubenmire 1975; Stromberg and Griffen 1996; Robertson and Kennedy 1954; Goodwin *et al*. 1999; Rickard 1995).

Horses and burros also create trails through areas in which they travel and these proliferate as they find alternate routes or seek new forage areas. The extent of trails within an area is an indication of the magnitude of impacts from these animals. Trailing and terracing effects of burros on NAWS-CL are evident in aerial photos of the Dust Bowl Springs area on the western slope of the Slate Range as shown in Figure 2.4-1. Trailing alters soil structure through compaction and disruption of surface horizons (Bohn and Buckhouse 1985). These changes often result in increased amounts of soil lost to erosion, a reduction in infiltration rates, decreased nutrient and oxygen levels, and resistance to root penetration (Adkison and Jackson 1996).

2.4.1.4 Interactions with Other Large Herbivores

It has been widely accepted that a great deal of dietary overlap exists among horses, cattle, and native ungulates, such as bighorn sheep. In a study of dietary relationships among wild horses and cattle in southeastern Oregon, McInnis and Vavra (1987), found that horses and cattle showed predilection for many of the same forages, and dietary overlap was substantial (62 to 78%) for every season. The potential for direct competition between horses and bighorn sheep, however, is likely to be minimal since horses are not usually found in areas inhabited by bighorns.

Competition for food, water, and space between bighorn sheep and burros is strongly suspected by many biologists, and overlaps of food and rangeland are known to occur. Researchers have found dietary overlap between burros and bighorns ranging from 20 to 67 percent (Douglas and Hurst 1993). Studies in 1961 and 1984 indicated that the presence of burros at springs had an inhibiting effect on bighorn ewes, although bighorn rams appeared to be less intimidated. The findings of the study suggested that bighorn ewes

generally would not drink if three or more burros were present at the spring. Rams drank at the springs burros utilized, but a spring not used by burros received much heavier use by ewes than springs used by burros. Burros have the tendency to congregate in groups at water sources, often remaining there for hours, or even entire days (Douglas and Hurst 1993).

2.4.1.5 Impacts to Cultural Resources

Significant discussion of historic and prehistoric cultural resources and impacts to these resources are provided in the Station's 1981 Environmental Impact Statement for feral burro management and in the 1982 Environmental Assessment for the interim wild horse management program (U.S Navy, 1981 and U.S. Navy, 1982). These documents describe damage to prehistoric sites as ranging from very minor to 100 percent damage to some sites (surface of midden areas). Damage is from a combination of trailing with soil compaction as well as erosion off of compacted areas. Erosion problems are compounded by the reduction of vegetative cover and animal dust baths or wallows. Damage associated with overpopulations of horses and /or burros is most pronounced at springs and seeps. These same areas also tend to support the highest density and diversity of prehistoric cultural resources. Additionally, damage to very old Paleo-indian sites on and adjacent to dry lake playas is considered highly significant due to the paucity of these ancient sites and the little amount of information concerning these sites collected to date.

Damage to historic resources has also been noted by animals rubbing on posts and roof supports of historic cabins and ground disturbance of can and trash dumps associated with these sites. Native Americans have also noted problems with horses and burros at the Coso Hot Springs sacred/religious site. The documents cited above indicate that with continued use of NAWS lands by wild horses and feral burros that continued degradation of historic and prehistoric sites is reasonably anticipated.

2.4.2 Mission Specific Impacts

The NAWS-CL lands have been withdrawn from the public domain and serve as the primary Navy facility for all aspects of developing and testing airborne weapon systems, including propulsion, guidance, fusing and warheads. Airborne electronic warfare systems are developed and tested at China Lake. Other non-military uses, such as recreational or commercial activities are secondary and accommodated on a non-interference basis. Horse and burro use of NAWS-CL lands has resulted in injury to personnel, created hazards to aircraft and pilots, and damaged Navy equipment. Past incidents include:

- Human health and safety hazards caused by burros present on the aircraft runways and adjacent aircraft taxi areas, singly or in bands of a dozen or more animals during flight operations;
- Chewing through radar cables, breaking water pipes, and using pad hardware for "back scratching" thus causing improper station alignment of sensitive instrumentation and other equipment;
- Hazards caused by burros accessing the supersonic rocket-sled track during sled operations; and
- Hazards caused by feral burros and horses crossing Navy roads, including incidents of vehicle collisions (U.S. Navy 1980).

Figure 2.4-1 Color Infrared Aerial Photo (taken August, 1997) of the Dust Bowl Springs Area Showing Extensive Network of Trails (enhanced in yellow) Created by Burros.

Figure 2.4-2 and 2.4-3 illustrate the problem of burros near sensitive equipment sites and the safety hazard they impose in active aircraft runway areas.

Perhaps the biggest concern is the potential for feral burros to cause a serious aircraft accident, especially at night. The NAWS-CL runways are delineated by standard runway lights located near ground level. They are only designed to mark the edge of the runway. They do not provide enough lighting for air traffic control tower personnel to see burros on the runways. In addition, any burro droppings on the runways must be removed prior to takeoffs or landings to prevent ingestion and fouling of engines, and due to the configuration of runway lighting, is not possible to ensure that this maintenance task is accomplished at night.

To the extent possible, the Navy has attempted to protect many areas in NAWS-CL from large animal ingress by fencing. However, much of the terrain at the boundary areas prohibits the placement of conventional fencing and barbed wire and cattle drift fencing were both found to be an ineffective means of controlling burros or horses. Because of these concerns, it was Command's belief that human health and safety, as well as the Center's mission, was compromised by these animals. As a result, a policy was implemented in 1980 to control these animals on NAWS-CL lands.

2.5 Population Status, Distribution, and Management Considerations

2.5.1 Herd Management Area Designations

According to BLM estimates, the total United States population in 2008 was about 29,644 wild horses and 3,461 wild burros, with some 3,112 horses and 766 burros in California (BLM 2010). Wild horses and burros are traditionally managed on a nationwide system of Herd Management Areas (HMAs). Thirty-two HMAs occur throughout the State of California. Management of 17 of these HMAs is identified in the CDCA Plan of 1980, as amended, and three of these were originally designated within portions of NAWS-CL: the Centennial HMA, Panamint HMA, and Slate Range HMA, (Figure 2.5-1). The Centennial HMA was designated for the long-term management of both horses and burros, and the Panamint and Slate Range HMAs were designated management areas for burros only. Figure 2.5-1 also identifies the Centennial Herd Area (HA), with HA meaning the geographic area having been used by a herd as its habitat as of 1971.

AMLs within each HMA were established through BLM land use plans, primarily the 1980 CDCA plan and amendments, to ensure public land resources, including wild horse and burro habitat, are maintained in satisfactory, healthy condition, and unacceptable impacts to these resources are minimized. In most instances, the AML for a HMA is expressed as an acceptable range. In some instances, however, the AML is expressed as a single number, representing the upper management limit for the HMA such as is the case with the Centennial HMA. Maintaining a thriving natural ecological balance, the biological/social need of the herds, economics of management actions, reasonable cycles of gathering, genetic diversity, and the population at which resource deterioration would be expected to begin were all considered by the BLM as important factors in the initial establishment of AMLs under the CDCA Plan.

Figure 2.4-2. Historic Photo (circa late 1970s) of Burros on NAWS-CL Aircraft Runways during Flight Operations

Figure 2.4-3. Historic Photo (circa late 1970s) of Burros on the NAWS-CL near Sensitive Missile Guidance Systems Equipment.

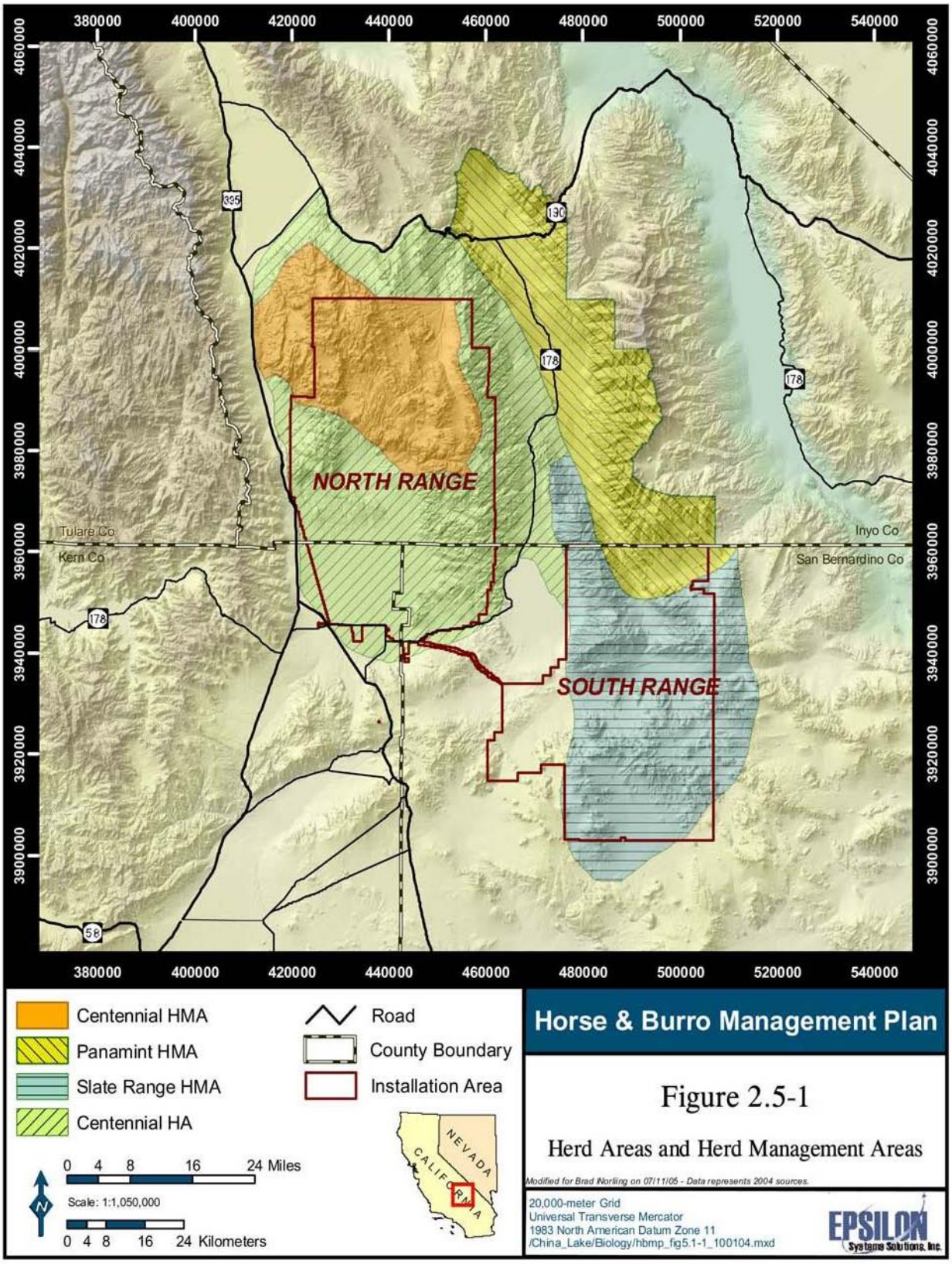


Figure 2.5-1. Herd Areas and Herd Management Areas

With regard to HMAs within NAWS-CL, the 1980 CDCA Plan initially recommended an AML for burros in the Panamint and Slate Range HMAs of 240 and 408 animals, respectively. The proposed AML for burros in the Centennial HMA was 1,137, whereas the recommended AML for horses within this unit was substantially lower at 168 animals (BLM 1980).

Through the process of implementing management of the CDCA Plan, some of the HMAs are divided for manageability, while some HMAs and portions of others were discontinued for one or more of the following reasons:

- Limited horse or burro numbers precluding maintenance of a viable herd,
- Unacceptable resource impacts from horse or burro use,
- The presence of restrictive fencing,
- Lack of publicly owned water, and
- Conflicts with the interests of private property owners and/or agencies responsible for the management of public and withdrawn lands.

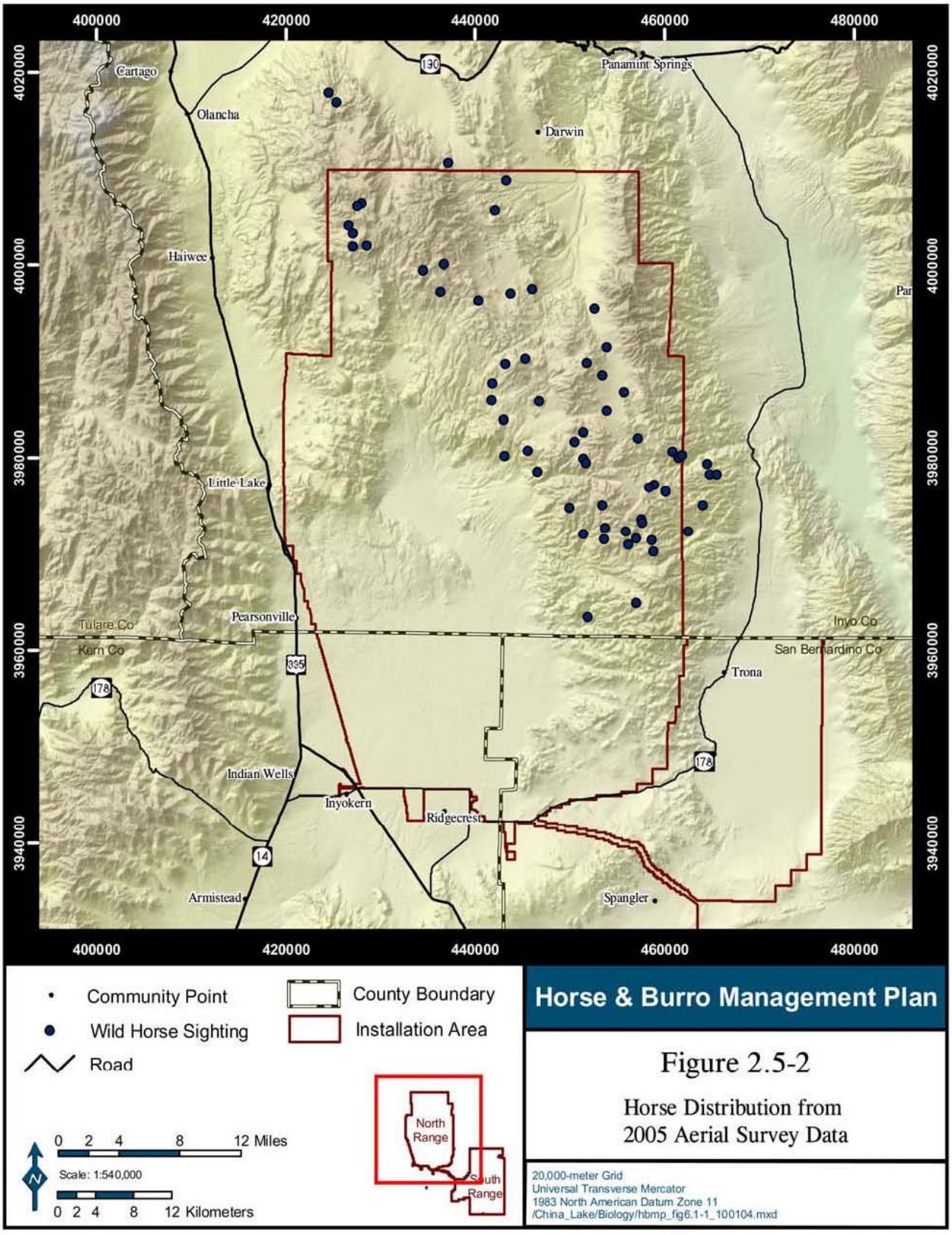
In 1981, Amendment 24 to the CDCA Plan was adopted to delete the Centennial and Slate HMAs for burros because of the conflicts they were imposing on NAWS-CL. In 1983, another amendment (No. 12) deleted the Panamint HMA. These amendments considered the NAWS-CL and Death Valley National Monument's management plans, which called for removal of burros from lands under their jurisdictions in areas bordering the Panamint HMA. Since burro migratory patterns overlap lands under the jurisdiction of all three agencies, it was determined to be infeasible to maintain a population on only BLM lands. Thus, the current population management level for burros in all three of the HMAs is now zero.

2.5.2 Horses

2.5.2.1 Range and Distribution

Figure 2.5-2 shows the distribution of horses within the Centennial HMA based on Global Positioning Satellite (GPS) data from an aerial survey conducted in January 2005. A total of 234 horses were counted in 71 groups. Average group size was 3.3 animals with a maximum group size of ten horses.

The horse distribution maps for the 2001, 2002, 2005, and 2008 aerial surveys indicate a consistent distribution pattern. Approximately 50 percent of the population continues to be located in the southern portion of the Argus Range, in areas immediately north and south of Mountain Springs Canyon, and between Wilson Canyon and Shepherd Canyon along the eastern boundary of the North Range (Figure 2.5-2). The other concentration area remains the Coso Range between Upper Cactus Flat and Coles Flat, and in the western and eastern portion of Wild Horse Mesa. Small, relatively isolated groups can be found throughout the remaining area (Figure 2.5-2). Although there have been no studies to determine seasonal movement and distribution patterns of wild horses in the Centennial HMA, it is likely that movement of animals between these groups occurs regularly.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Olancha
Panamint Springs
Darwin
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Little Lake
Pearsonville
Tulare Co
Kern Co
Inyo Co
San Bernardino Co
Trona
Indian Wells
Inyokern
Ridgecrest
Armistead
Spangler
130
395
178
14
Community Point
Wild Horse Sighting
Road
County Boundary
Installation Area
0 2 4 8 12 Miles
Scale: 1:540,000
0 2 4 8 12 Kilometers
North Range
South Range
Horse & Burro Management Plan
Figure 2.5-2
Horse Distribution from
2005 Aerial Survey Data
20,000-meter Grid
Universal Transverse Mercator
1983 North American Datum Zone 11
/China_Lake/Biology/hbmp_fig6.1-1_100104.mxd

The majority of horses can usually be found in Great Basin mixed shrub, Mojave mixed woody shrub, and sagebrush and blackbrush scrub habitats in areas above 4,500 feet (1,372 m) in elevation. Habitat suitability is likely correlated with the distribution of available water sources, as well as the interspersion of vegetation associations and related seasonal availability of quality food plants.

2.5.2.2 Population Status and Trend

The Centennial HMA was found to have the highest concentration of wild horses in the CDCA in 1980, with an estimated population of 740 horses. Populations within the Centennial HMA peaked in 1982 at over 1,300 animals, with an increase of 15 and 37 percent from the previous years of 1981 and 1980, respectively (Figure 2.5-3, Table 2.5-1). This sharp jump in population levels may be attributed to real population growth during this period or to enhanced survey technique and more intensive survey effort.

The current horse population is well above the CDCA recommended AML of 168 animals. Beginning in 1983, horse numbers started to rapidly decline due to the implementation of annual gathers (see Section 2.5.2.3 below, [Figure 2.5-3, Table 2.5-1]). Horse numbers leveled in the mid-1990s and remained relatively stable into the 2000's with a slight increase in estimated numbers during 1999 and 2000. The population stayed relatively stable through 2008. Then the herd spiked in a two-year period from the 2008 census (254) to the 2010 census (459). The 2008 census crew estimated that ten to 20 percent of the herd was not counted. Alternatively, the 2010 census crew speculated that some animals may have been double counted. However, neither could be verified and both the censuses remain intact. For planning and modeling purposes, the Fall 2009 population is estimated at 300, and the Fall 2011 population at 532 after adding the 2011 foal crop to the 2010 census.

2.5.2.3 Gather History

Annual gathers and placement through the BLM adoption process has been the only technique used to control horse numbers on the Station. Since 1983 more than 3,200 horses have been removed from the Centennial HMA.

Beginning in 1983, the number of horses gathered steadily increased until 1985, when nearly 700 animals were removed (Figure 2.5-3, Table 2.5-1). By the mid- to late-1980s, declines in horse population levels were apparent. No horses were in the gathers conducted in 1986 and 1988. Annual gathers resumed again in 1989 with the removal of over 350 animals by 1990. The number of horses gathered declined during the mid- to late-1990s. Horse population levels remained relatively stable during this period (Figure 2.5-3, Table 2.5-1). The number of horses gathered reached a low of six in 2008 and averaged 23 animals from 1999-2009.

Younger horses (typically less than five years old, and more recently only those less than two years old) are placed for adoption through the BLM's Wild Horse and Burro Adoption Program. Older horses are placed in long-term holding facilities. The adoption program is generally the only available option to place younger animals that are removed from HMAs such as the Centennial HMA located on NAWS. The adoption market directly affects the management of horses. If adoption targets are not met, BLM preparation and holding facilities can quickly reach capacity. When the facilities become full, gathers must be slowed or curtailed. Thus, the adoption market has a kind of domino effect not only on the gathering process, but also on the long-term goal of achieving and maintaining desired herd size.

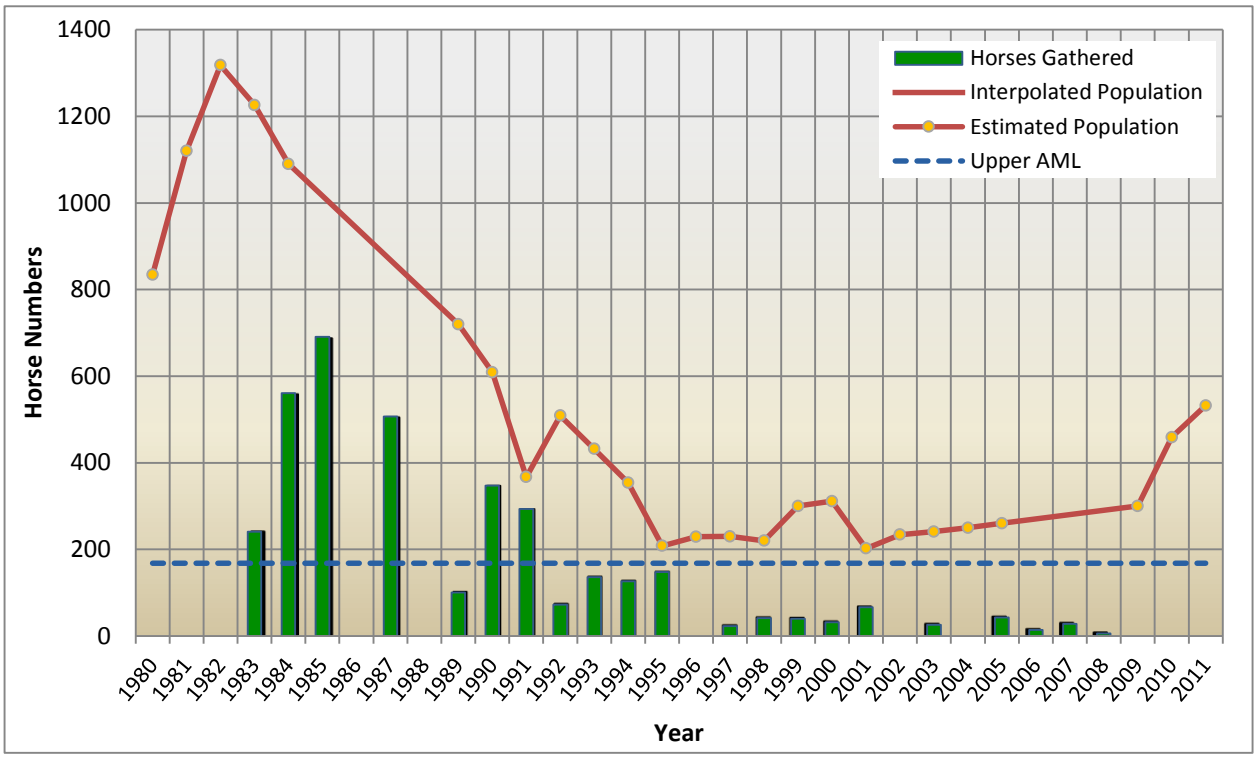


Figure 2.5-3 Estimated Population Levels and Gather Numbers for Wild Horses in the Centennial HMA From 1980-2011.

Table 2.5-1. Removal Numbers and Population Estimates for Wild Horses and Burros in the NAWS-CL from 1980-2013.

Fiscal Year	Number Removed		Population Estimate	
	Burros	Horses	Burros	Horses
1980	0	0	3,684	834
1981	799	0		1,120
1982	3,389	0		1,318
1983	1,644	241		1,226
1984	932	561		1,090
1985	429	691		
1986	244	0		
1987	481	507		
1988	479	0		
1989	241	100		720
1990	167	347	161	609
1991	82	293		367
1992	127	72		509
1993	119	136	300	432
1994	190	126	100	354
1995	244	148	100	208
1996	0	0	116	229
1997	45	23	118	230
1998	60	41	115	220
1999	68	40	55	300
2000	174	32	150	311
2001	220	66	100	202
2002	0	0	116	234
2003	73	26	62	241
2004	75	0	75	250
2005	39	43	90	260
2006	50	14		
2007	0	28		
2008	41	6		254
2009	20	0	150	300
2010	64	0		459
2011	80			532
2012	100	0		
2013	0	0	150	450-500
Total:	10,676	3,541		

At this time, the cost to capture, handle, care for, and adopt young adoptable horses can exceed $2,200 per animal. If older animals (those that require placement in sanctuaries) are captured, then a cost of $6,000 per animal for long term holding needs to be factored in. Normally, as horse numbers decline the ability to effectively gather is expected to decline, and cost per animal increases. However, current gather efforts (contracts) are conducted on a per animal basis, so difficulty in catching animals has only an indirect bearing on cost per animal (due to increasing helicopter use rate changes in subsequent contracts).

2.5.2.4 Herd Composition

A horse population is not only defined by its size and distribution, but also by parameters that indicate recruitment and mortality. While aerial surveys can provide recruitment data such as the ratio of foals to

adults in a population, more specific information on the age class distribution and sex ratios of the herd can only be obtained on the ground when gather operations are conducted. Although gathers for wild horses occurred annually between the period of 1997-2001, and again for 2003-2008, the small proportion of animals handled in relation to the estimated population totals for each year, limits the usefulness of any data collected.

The most current and complete herd composition information for horses in the Centennial HMA is from gathers conducted in 1995, where 88 percent (305 individuals) of the estimated population of 346 horses was gathered. Analysis of these data indicates that pre-removal sex ratios deviated slightly from a near-natural ratio of 50/50 and were skewed to 53/47 in favor of males. The foaling rate was estimated at 25 percent. Foal production is an important consideration for management. The number of foals recruited into the yearling class is a useful indicator of a herd's population trend.

Age distribution data from gathers conducted in 1995 is presented in Figure 2.5-4 and shows that approximately 11 percent of the pre-removal population was comprised of horses zero to one years in age, 19 percent two to five years in age, 22 percent six to ten years in age, and 48 percent over ten years in age. This indicates that the population is made up primarily of older horses. Age distribution data represent one of the primary sources of herd composition information and is the cornerstone to modeling horse herd dynamics. The 20-year-old column on Figure 2.5-4 accounts for 20-year and older animals. The accuracy of aging horses over 20 years declines rapidly. For that matter, it is common for wild horse herds to only have two percent of the herd in the 18 and older age class (Phillips 2010, *pers*. *comm*.).

There is no information on horse mortality in the Centennial HMA. However, past horse mortality rates in this herd are believed to generally parallel those documented by Berger (1977), and Garrott and Taylor (1990) where mortality rates of wild horses ranged from three to five percent for herds in Montana and Nevada, respectively.

According to the CDCA Plan, "positive proper management by BLM is required to achieve and maintain population levels to ensure healthy herds and animals and to maintain a thriving natural ecological balance through reduction, eliminating conflicts now creating severe adverse impacts on other highly valued natural resources, especially wildlife."

2.5.2.5 Genetic Variability[1]

The measure of genetic diversity for the Centennial HMA was obtained from blood samples of 69 horses collected during gatherings conducted in 2001. Blood samples were analyzed by the University of Kentucky Equine Blood Typing Research Laboratory using seventeen genetic marker systems. The results were presented in a report by Cothran (2001). The following summarizes key aspects of the report as they pertain to the genetic diversity of horses in the Centennial HMA:

[1] Adapted from the previous NAWS-CL Wild Horse and Burro Management Plan (Epsilon 2005).

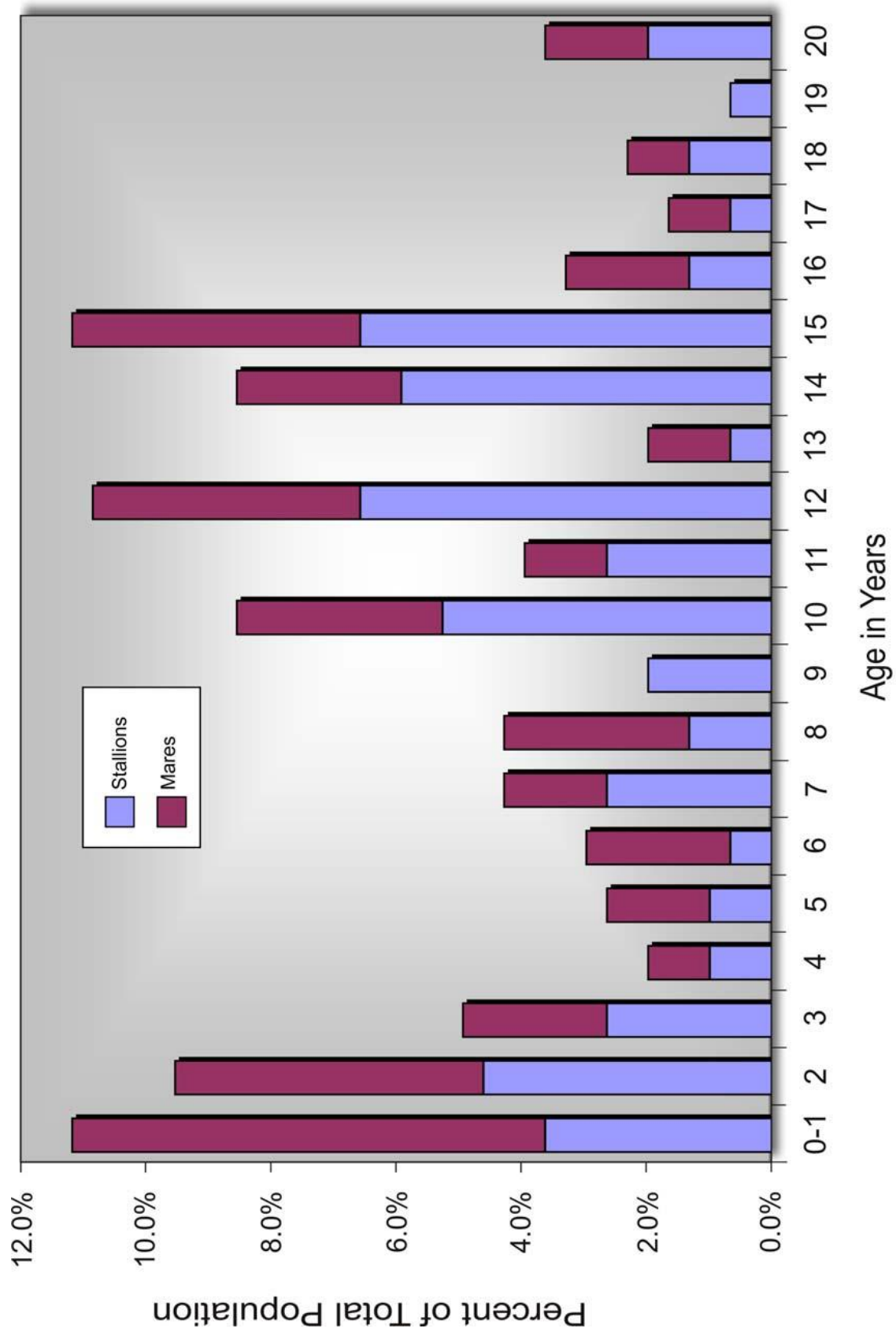


Figure 2.5-4 Pre-Removal Sex-Ratios of Wild Horses by Age Class for Gathers Conducted in the Centennial HMA During 1995.

- The highest genetic similarity of the Centennial herd is with the North American Gaited Breeds followed by the Oriental and Arabian Breeds.
- Genetic variation within the Centennial herd is low but not critically low. Observed heterozygosity was reported at 0.325, which is lower than the feral horse mean (0.360) but still above 0.310, the proposed critical threshold.
- The herd exhibits a large number of low frequency variants which is suggestive of a mixed origin of the herd, perhaps with a small number of recent introductions.

There appears to be a limited influx of outside genes in recent times and that genetic variation in the herd could be declining. The major concern for small populations is loss of genetic variability or "heterozygosity," through genetic drift (loss of genetic frequencies between the parents and their next offspring due to chance alone) and/or inbreeding. Loss of genetic variability can lead to lower overall health (loss of adaptability), while inbreeding can result in reduced viability or fertility. Maintenance of genetic variability is discussed in Section 3.2.2 below.

2.5.3 Burros

2.5.3.1 Range and Distribution

Burros can be found to occupy nearly all areas of the Station. During the cooler winter and spring months, and particularly during the years of adequate rainfall with springtime green up of annual and perennial vegetation, burros can frequently be found in low-lying areas well away from perennial water sources. During the summer months, burros are typically found in the higher elevations and canyons with reliable sources of water.

2.5.3.2 Population and Removal History

In the absence of any natural control mechanisms and with no effective way to remove animals, burro (and horse) populations within NAWS-CL and surrounding region exploded in the 1970s and early 1980s. The first reliable population estimate of burros within NAWS-CL was obtained from aerial surveys conducted in 1980, which indicated there were approximately 2,225 burros concentrated in six main herds ranging throughout the entire Station. Surveys conducted the following year in 1981, indicated that burro numbers were much higher than previously thought, with an estimate that ranged from 3,500 to 5,700 animals.

Burro reduction efforts began in 1980, when an estimated 258 animals were live-captured and removed during the period of March 1980 to January 1981 (Kovac 1983). In March 1981, another 649 burros were removed by direct reduction (shooting), which was an emergency measure, implemented due to the presence of burros on the airfield and damage to inner range test sites. As a result of the emergency reduction adequately reducing the safety issue at the airfield and damage to test sites, control measures were implemented that resulted in the live-capture and removal of another 606 burros during the period of June 1981 to February 1982. Since this time all reduction efforts have been through gathers and adoptions of captured animals to the general public through the BLM's adoption program.

The number of burros removed from NAWS-CL lands increased dramatically from 799 in 1981 to 3,389 in 1982 (Table 2.5-1). The numbers of burros removed, although still high, continued to decline over the next several years until 1985, when it was apparent that removal efforts were having a dramatic effect on burro population levels, as fewer and fewer animals were found with each subsequent year of removals.

During the period of 1981 through 1985, approximately 7,193 burros were removed from NAWS-CL (Table 2.5-1).

The annual number of burros removed continued to decline during the late-1980s and early-1990s when management emphasis shifted toward reductions at a lower maintenance level (Table 2.5-1). Since 1981, well over 10,000 burros have been removed from the NAWS-CL rangelands and placed in the BLM's adoption program. Annual removals and adoptions have become the standard procedure by which burro populations are controlled.

3.0 ANIMAL AND HABITAT MANAGEMENT

3.1 WHBMP GOALS

- Maintain the Centennial Horse Herd within a range of 100 to 168 animals to allow for range recovery, and to maintain genetic variability and herd health. Allow for changes in this initial range over time based on habitat condition, vegetation utilization, animal numbers and distribution, and herd health.
- Achieve and maintain the burro population at zero.
- Keep the Herd healthy and self-sustaining by maintaining and improving rangeland condition. Remaining horses will be healthier and better able to survive stressful periods such as prolonged droughts and harsh winters when the rangeland resource is in a self-sustaining condition.
- Maintain herd genetic variability/diversity by periodically conducting genetic analysis on the horse herd and, if warranted, by the possible introduction of animals from other suitable herd areas, removal of young animals and/or by increasing the number of male horses and therefore the number of possible harems.
- Implement a proactive fertility control program through the application of contraceptive to breeding age mares.
- Increase the health and adoptability of horses by taking only young animals when extracting excess, by allowing the breeding herd to live out their lives on the range, and by carefully selecting the young animals to be retained. The younger animals are more marketable to the adopting public, and the herd genetic quality will improve through thoughtful selection of breeding herd recruitment.
- Minimize the cost of reducing and maintaining desired population levels.
- Minimize damage to water resources, riparian areas, uplands, and cultural resources through Herd reduction, and thereby facilitate and increase the rate of native plant and animal population recovery, including federally listed species.
- Provide for an enhanced habitat assessment program to monitor forage utilization and recovery) and an animal monitoring program to document herd size, health, and distribution.

3.2 WILD HORSE MANAGEMENT

3.2.1 Management Elements

3.2.1.1 Appropriate Management Level

As mentioned earlier, an AML of 168 horses was set for the Centennial HMA in the CDCA Plan in 1980. The AML was set as the upper management limit for the herd. BLM has now adopted the policy that all AMLs should be expressed as a range with the higher figure being the upper limit, and the lower figure the lower limit. The intent is to keep the population within the range. The lower limit should allow maintenance of a self-sustaining population, and at the same time enable a minimum feasible level of management. The latter means that activities such as helicopter gatherings, removals, and census would occur as infrequently as possible (three to five years) (BLM 2003). The upper limit must be consistent with the objective of maintaining a "thriving natural ecological balance" (BLM 2003). That was the test that the 168 horse upper

limit met in the CDCA Plan. In actuality, the estimated horse population has ranged from a high of 1,318 in 1982 to a low of 202 in 2001 (See Table 2.5-1).

The lower limits are commonly set at 40 percent below the upper limits of the management range (BLM 2008). In the Centennial case, that would calculate to a lower limit of 100. The 40 percent provides enough range so that the frequency of gathering and removal activity can be reduced with three- to four-year intervals before another gather and removal is triggered. This is the basis of targeting an AML with the range of 100 to 168 for the Centennial Herd

The goals of this WHBMP include retaining a horse herd of 100 to 168 animals that is "healthy, genetically viable, and self-sustaining." The CDCA initially provided for 1,137 burros and 168 horses, plus a cattle grazing permit in the Centennial HMA. Elimination of the burros and cattle suggests that forage and habitat for wild horses in the HMA has been freed up and is still available. Given this situation, it does not appear prudent to reduce the horse upper limit below 168. However, inclusion of an AML range with a lower limit is considered prudent, to ensure a maximum 168 horses, this range can be implemented without requiring an amendment to the CDCA Plan. Removals would periodically take the population down to the lower limit, followed by the population increasing back to the upper limit before triggering more removals.

3.2.1.2 Census

The techniques being used by NAWS-CL to census horses and burros include using helicopters capable of transporting at least four observers (including the pilot). Transects are spaced approximately 0.5 mile apart and the flight is along a predetermined north-south pattern. The pilot navigates as closely as possible to the transect line as determined by GPS equipment while minimizing maneuvers in order to maintain nearly level flight at a pre-designated altitude and air speed. Surveys are typically conducted annually prior to roundups. BLM Wranglers are on all flights to assist with spotting, assessing animal health and to identify individuals or groups of horse to avoid double-counting of animals.

BLM has been directed by the General Accounting Office (GAO) to adopt and employ statistically based methods to estimate animal populations agency-wide, in order to improve the accuracy of population estimates. BLM subsequently committed to a policy to implement two advanced census techniques - Simultaneous Double Count and PHOTO Mark Re-sight. The techniques were developed through cooperative research conducted by the U.S. Geological Survey. The BLM, with the assistance of the USFS, will train its personnel on the use of these techniques and will continue to refine their use as necessary (BLM 2009b). Both methods provide a statistically based element to adjust for animals not seen.

NAWS-CL could access this technology from BLM through the Interagency Agreement, obtain training, and consider implementing it on the Centennial Herd. Alternatively, there is a post gather census technique that, while not widely adopted in BLM, has been demonstrated to yield more accurate results at far less cost than standard BLM census practices. The practice is to do post-gather rather than pre-gather census. If 80 percent of a herd is gathered, analyzed in captivity, and the mares treated for fertility control, absolute census accuracy is maintained in greater detail than can be obtained by a pre-gather census. Then, before animals are turned back out, aerial census is conducted of the 20 percent remaining. This method obviously requires far less time and expense. The data gathered from the captive animals is then combined with the post gather aerial census resulting in highly accurate results for the entire herd (Phillips 2009, *pers. comm.*). While holding animals, doing a count, transporting the animals to a holding facility and then back out onto the Ranges would be expensive, the benefit

of improved census data (age classes, sex ratios, health, etc.) plus being able to introduce a fertility control treatment could outweigh this cost (Tom Campbell, *pers*. *comm*.). Animals being temporarily held will be vaccinated, provided medical care if needed, and collared to facilitate being returned there original use area as a family group.

Use of the post-gather census technique is recommended for the Centennial Herd. It is further suggested that NAWS-CL examine the statistically based techniques, along with the cost of training and application, to determine if the technology is deemed worthwhile for application to the smaller post-gather numbers. Figure 3.2-1 provides wild horse census, sighting, and distribution results in 2005 (2010 results are in Appendix J), as well as a horse distribution boundary. This boundary embraces the area regularly used by the horses. It is not to be confused with the HMA boundary. Table 3.2.2-1 provides census results from five years.

Table 3.2.2-1. Wild Horse Census Data for the NAWS, 2001 - 2010

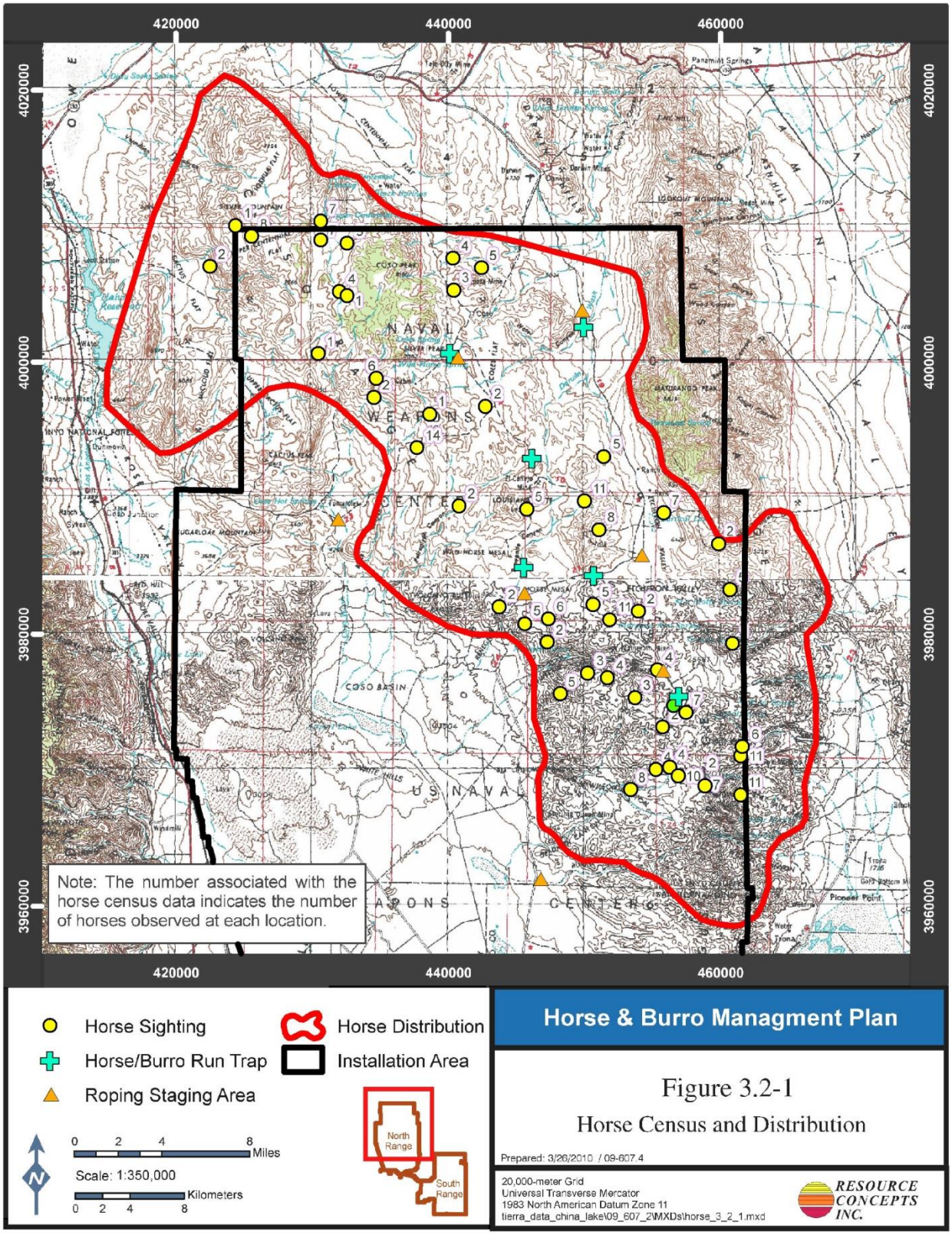
YEAR	ADULT	YOUNG	TOTAL
2001	169	6	175
2002	172	38	210
2005	193	41	234
2008	239	15	254
2010	362	77	459

3.2.1.3 Gathering

Appendix E provides a description of the four gathering methods used by NAWS-CL: (1) Helicopter Roping, (2) Helicopter Run Trap, (3) Saddle Horse, and (4) Bait or Water Trapping. Helicopter Roping entails herding animals to a designated area where cowboys on horseback can rope the animals. Helicopter Run Trap entails setting up funnel traps and herding the animals into them with a helicopter. Saddle Horse means driving the animals into traps or roping animals using mounted cowboys without the aid of a helicopter. Bait or Water Trapping entails luring the animals into traps with feed and/or water. Once the movable gate trigger is set animals can enter the trap but cannot exit since the opening swings shut behind them. Experience and skill are essential for applying the four methods in the most advantageous manner.

Selection of gathering crews is important. Crews must possess the equipment and experience to conduct gathers in a cost-effective and humane manner. Knowledge of the local terrain facilitates gather efficiency. Helicopter pilots must understand horse and burro behavior and have significant experience with these operations to allow for safe, expeditious gathers while minimizing unnecessary stress to the animals.

When horses are gathered and later returned to the rangeland, care should be taken to return them to the home rangelands from where they were taken. Research has revealed that horses show remarkable fidelity in their annual use of home rangelands (Berger 1986). It is also important to ensure that family groupings are retained to the extent practicable. Returning horses to their familiar home range as a family group is considered an important stress reducer by ensuring that they are familiar with the resources in the area and by avoiding unnecessary competition associated with re-establishing desirable associations with the rest of the herd.


420000
440000
460000
4020000
4000000
3980000
3960000
NAVAL
WEAPONS
CENTER
COSO BASIN
U S NAVAL
Note: The number associated with the horse census data indicates the number of horses observed at each location.
Horse Sighting
Horse/Burro Run Trap
Roping Staging Area
Horse Distribution
Installation Area
0 2 4 8 Miles
Scale: 1:350,000
0 2 4 8 Kilometers
North Range
South Range
Horse & Burro Managment Plan
Figure 3.2-1
Horse Census and Distribution
Prepared: 3/26/2010 / 09-607.4
20,000-meter Grid
Universal Transverse Mercator
1983 North American Datum Zone 11
tierra_data_china_lake\09_607_2\MXDs\horse_3_2_1.mxd
RESOURCE CONCEPTS INC.

Testing and training tempos on NAWS-CL are high, and may at times preclude access to certain gathering locations. Also, BLM schedules, foaling season and summer heat will affect gather schedules. All of these factors need to be considered when preparing gather plans.

3.2.1.4 Removal

Gathering of some or all of a herd of wild horses usually leads to the removal of animals although some may be released at the gather site or returned to the range at a later time. While the prevailing attitude may be that removal is the main purpose for gathering, the first priority is actually to identify the animals that will be retained in the wild herd. During the selection of retention animals, the manager has the greatest opportunity to modify herd composition (sex ratios, age class distribution, etc.). This is particularly true once the herd has been stabilized and the breeding herd is allowed to live out their lives on the rangeland. Then the recruitment animals, as well as the excess to be removed, come exclusively from the youngsters. The recruits should be selected first. At the outset, that will mean that some less desirable animals will go for adoption. Nevertheless, the priority is to retain the best so that the herd is constantly upgraded and eventually produces the most desirable animals possible for future adoption.

Gate-Cut Removal is a practice that has, to date, dominated the gather and removal of excess animals from public lands. The helicopter pilot brings in the first and easiest animals he locates. They are corralled into traps and loaded onto trucks indiscriminately. In this practice, the main objective is to reduce the herd in the least time with the least expense. The practice takes a heavy and random toll on the genetic makeup of the herd, not to mention the cost of sending mature unadoptable horses to long term holding. Selective Removal is the antithesis of Gate-Cut Removal.. Selection criteria (for age, color, confirmation) should be developed for each specific herd. Suggested selection criteria for the Centennial Herd will be scientifically based and rely on inputs from acknowledged equine experts and are shown below.

Centennial Herd Selection Criteria:

Age – The age criteria will be determined by the management Strategy that is selected. The recommendation is to remove the excess from the age class of two years and under once the herd is stabilized in the 100 to 168 range. The breeding herd would then be allowed to live out their lives on the rangeland. Since the adoption market has, in the past, accepted up to five-year-olds, this age class criterion could be adjusted to five years, as the market warrants.

Conformation – Use standard conformation guidelines to guide the selection of young replacement animals for the herd.

Color – There is a good mix of colors in the herd. Continuation of the same mix appears appropriate.

Undesirable characteristics – Any breeding stock that possess undesirable characteristics such as glass eyes (very light colored), and white face markings around the eyes should be removed by adoption or placement in long-term sanctuaries to prevent perpetuation in the herd.

If sanctuary space and funding allows, the BLM has the ability to place unadoptable animals from the Centennial Herd into short-term holding facilities where they would be provided health checks and otherwise prepared for placement into long-term holding facilities barring any changes due to court actions (DiGrazia 2010, *pers. comm.*). Should the BLM not be capable of accepting animals into their program the

Navy may consider placement with other organizations or individuals capable of properly caring for excess animals.

3.2.1.5 Fertility Control

Fertility control has become a widely used tool for assisting managers in slowing reproductive rates and increasing the effectiveness of gather operations. A study by Bartholow (2004) indicates that fertility control alone may reduce variable operating costs by about 21 percent. Combining fertility control with other management practices such as a slight alteration in the naturally occurring sex ratio and selective removal may reduce costs by 31 percent or more (Bartholow 2004).

Currently, the most widely used and recommended fertility control method is the Porcine Zona Pellucida (PZP) vaccine. PZP has been studied for reproductive control in domestic animals and wildlife since 1989. The zona pellucida is a membrane that coats the egg. Sperm must bind to and penetrate the zona pellucida to fertilize the egg. Immunizing an animal with zona pellucida from pigs causes the production of antibodies that bind to the host's zona pellucida and prevents fertilization of the egg. Females successfully immunized with PZP will cycle and ovulate normally but will not conceive (U.S. Department of Agriculture [USDA] Animal and Plant Health Inspection Service [APHIS] 2009).

The current research indicates that PZP use is effective, humane, and reversible with no ill effects on ovarian function if mares are not vaccinated for more than three consecutive years (Miller *et al*. 2001; Kirkpatrick 1992; Kirkpatrick and Turner 2003; Bartholow 2004; BLM 2003b). The vaccine can also be administered to pregnant mares without causing any adverse effects to the foal (Kirkpatrick 2005). The following year the mare will be infertile. Numerous sources provide anecdotal evidence that body condition, life expectancy, and foal health improve in mares under a fertility control program. With proper management, all mares can be allowed to contribute to the gene pool while still utilizing fertility control to reduce the reproductive rate of the herd.

The PZP vaccine provides 94 percent infertility if administered annually. This can be accomplished using annual gathers or, more commonly, through remotely administered darts. This practice is typically used in small, accessible, or sensitive populations such as the Assateague Island herd (Kirkpatrick 2005) and the Pryor Mountain herd (BLM 2009b). The majority of herds implementing PZP vaccination use a 22-month controlled release formula administered in conjunction with a gather. This 22-month formula provides infertility at 94 percent for Year 1, 82 percent for Year 2, and 68 percent for Year 3 (Bartholow 2004; Turner *et al*. 2005). Fertility returns to normal on the fourth year.

PZP has not yet been approved for commercial use and is currently administered through research programs. In 2006, regulation of PZP was transferred from the federal Food and Drug Administration to the Environmental Protection Agency (EPA), which regulates wildlife contraceptives as “pesticides” under the Federal Insecticide, Fungicide, and Rodenticide Act. PZP is classified as an Investigational New Animal Drug and some level of monitoring will continue to be required until such time as the Food and Drug Administration (FDA) or the EPA either reclassify the vaccine or provide some other form of relief (BLM 2009a).

Implementing a fertility control program would require additional effort in capture, handling, and monitoring. To maximize treatment results, 50-90 percent of all breeding aged mares within the herd must

be captured and treated. For treatments conducted in coordination with a multi-year gather cycle, the ideal treatment objective should be 90 percent. Fertility control programs operated through the BLM's research authorization must include freeze branding of treated mares (coordinated with the state brand inspector), post treatment aerial surveys, information on sex-ratio and age structure submitted after the first post-treatment gather, and a Gather, Removal, and Treatment Summary report submitted to the BLM Wild Horse and Burro National Program Office (BLM 2009a).

BLM research administrators have indicated that the Centennial Herd could easily be included in the BLM's current EPA authorized PZP fertility control program. Requirements include completion and submission of a management plan including PZP fertility control and approval from the national Wild Horse and Burro Program office (Shepherd 2009, *pers. comm.*). Specific requirements (schedule, number of animals requiring treatment, costs, etc.) associated with the application of contraceptives will be determined through consultation with the BLM, EPA and other agencies or knowledgeable organizations and individuals.

One specific PZP that will be assessed for use is SpayVac®. This immocontraceptive vaccine has been shown to potentially have long-lasting (three year) efficacy in horses and will be considered for application in the China Lake herd. Additional information on this specific contraceptive can be found online (http://www.fort.usgs.gov/Research/research-tasks.asp)

Research is currently underway to develop oral contraceptives for use in wildlife control. Success has been seen in feral pigeons and Canadian geese but has been limited for other wildlife species (APHIS 2009). An oral contraceptive for use in feral horse populations could potentially reduce management costs by reducing the frequency of gathers while slowing the growth rate of the herd. This concept is further discussed in Appendix F: Future Possibilities for Oral Contraception.

Selection of the specific form of contraceptive that will be administered will be based on the specific compound's suitability for application to the herd, approval by EPA, costs and funding availability, and through consultation with appropriate agencies, organizations and individuals.

Although use of contraceptives is the preferred method of fertility control the Navy may also consider chemically or surgically sterilizing male and female individuals.

3.2.1.6 Sex Ratio

Adjustments made to the naturally occurring sex ratio within a herd can have a significant impact on the genetic diversity and reproduction rate of the herd. A higher population of males will result in larger number of small harems, increased competition between males for mares, and a higher interchange rate of mares between harems. A positive result of a higher male: female ratio will be that more males produce offspring and there would be a lower rate of predicted loss of genetic diversity, given the same-sized population (Singer and Schoenecker 2000; Coates-Markle 2000).

Some analyses indicate that modest changes in herd sex structure could slow the growth rate of the herd on a level comparable to use of contraceptives (Bartholow 2004). When small alterations in the sex ratio are combined with fertility control, even greater reductions can be seen. The sex ratio found in most feral horse herds is approximately 50:50 males and females, resulting in a median growth rate of 19.8 percent annually. Modeling indicates that adjusting this ratio to 53.1 percent males will result in a median annual growth rate

of 18.1 percent. Further increasing this ratio to 55.1 percent males' results in a 16.6 percent growth rate, while a ratio with 57.3 percent males could result in a 14.5 percent growth rate (Bartholow 2004).

Detailed analysis of the Centennial HMA herd was last completed in 1995 and indicated a sex ratio of 53:47 in favor of males (Epsilon 2005).

Herd sex ratios favoring males appear to cause stress and turmoil in the herd as the male component is increased. Stress would potentially be increased by greater competition for females including increased conflict between studs with harems and challengers, and a greater frequency of mares being "stolen" from existing harems. This could lead to greater physical trauma due to fighting and a decrease in fitness as time is diverted from foraging. No research has been located that addresses this stress factor. The stress could possibly be mitigated by gelding the number of studs in excess of the female component, but this too has not been researched. Pertinent to this point, the Nevada Wild Horse Range Herd Management Area Plan (BLM 2008) explores the option of gelding a significant number of studs and creating a non-breeding component in the herd. If this option is implemented, it should be closely monitored and analyzed for clues to the feasibility of using the gelding treatment as a stress reduction factor and its effect on genetic diversity. The desired sex ratio and age class structure of the herd will be determined prior to implementation of this possible management technique.

3.2.1.7 Adoption Program

The adoptability of animals that are removed from a herd is influenced by the selection practices that are used for the animals that are retained and removed from a herd. This is discussed in 3.2.1.4 Removal.

Beyond that, adoptability and demand is increased by public attraction to the animals in a herd. Public relations techniques can be applied to increase the public attraction such as movie films, tours, pictures, special events, speeches, publications and sundry other means of promotion. Promotional campaigns have been successfully implemented for the Pryor Mountain Wild Horse Herd in Montana and the Keiger Wild Horses in Oregon, as examples. Buyers throng to adoptions when they are held for these two herds (Nunn 2009, *pers. comm.*). The Centennial Herd is a good candidate for such promotion. "China Lake" already has high name recognition. The herd stands out by virtue of its isolation from other herds.

Increasing public interest in wild horse adoption is vitally important in the current economic climate. Adoption success has steadily declined over the past decade. BLM records indicate that between 1990 and 1999 over 70 percent of all horses removed from public lands were successfully placed through adoption (BLM 2009c). Horses up to the age of 4 years old were projected to have a 96 percent adoption rate (Irons *et al*. 1990). Current data from the BLM estimates the successful adoption rate for ages zero to one at 90 percent, two-year-olds at 50 percent, and three- to five-year-olds at 33 percent. Horses over the age of five have an eight percent adoption rate (BLM 2007). These statistics are problematic from a herd management standpoint as the number of horses to be removed to reach AML on public lands may greatly exceed the number that the adoption market can support, and further depress the market. That is all the more reason to promote adoption of the youngsters from the Centennial Herd.

A certain amount of attraction already exists for the Centennial Herd. Adopters periodically inquire when Centennial horses will be available (DiGrazia 2009, *pers*. *comm*.). A promotional campaign is

recommended for the Centennial Herd. Should the economy improve, or demand for adoptable horses increase, it is possible that older horses (up to the age of five) could be adopted.

The BLM is currently considering the establishment an Equine Guided Education (EGE) program in conjunction with EGE organizations. These programs foster the development of mustangs and burros with one of the goals being to increase their adoption potential. The human participants learn about wellness and leadership. These types of programs focus on horse-human partnerships and involve surrounding communities, typically using already available budgets. The program currently being considered is the Warrior Wellness Program which is designed to help war veterans re-acclimate to civilian life.

3.2.1.8 Herd Monitoring

The initiation of fertility control procedures will generate new needs for monitoring (BLM 2009a). The BLM Instruction Memo states that the following standard data will be collected during all post treatment surveys:

- Total number of adult (yearling and older) horses observed.
- Total number of foals observed.

Procedures are just now evolving for the new fertility control practice. NAWS-CL should monitor changes in BLM procedures for data collection as BLM gains further experience. The following is advised:

1) At the outset, collect blood or hair samples at every gather to detect changes from the baseline genetic diversity.
2) Record sex and age of animals removed, and animals retained, to help monitor the age class distribution and sex ratio of the herd.
3) Record body conditions (Henneke Condition Scoring Method, Appendix I) during gathers.

3.2.2 Genetic Variability[2]

The concept of genetic effective population size (Ne), more commonly referred to as minimum viable population size, has been a central issue in conservation biology since the formal inception of the discipline (Soule and Wilcox 1980). In a basic sense, Ne is the minimum number of breeding individuals that must be maintained for a population to survive a given period of time. The major concern for small populations is loss of genetic variability or "heterozygosity," through genetic drift (loss of genetic frequencies between the parents and their next offspring due to chance alone) and/or inbreeding. Loss of genetic variability can lead to lower overall health (loss of adaptability), while inbreeding can result in reduced viability or fertility.

Although no standard goal for Ne currently exists for wild horse herds, a generally accepted Ne equal to 50 (which comes from domestic breeding guidelines) is commonly recognized. Limited research into wild horse herds (i.e. Pryor Mountain and Assateague Island National Seashore populations) has demonstrated that the Ne for a herd under a natural age structure is approximately 30-35 percent of the total census

[2] Adapted from the previous NAWS-CL Wild Horse and Burro Management Plan (Epsilon 2005).

population size (BLM 2003b). As a general rule of thumb a total population size of about 150 animals is needed to support an Ne equal to 50.

An accurate calculation of Ne for a specific herd is difficult to determine since it is often confounded by a host of different factors. The harem structure of a population, for example, greatly limits male participation in breeding, thus creating an uneven ratio of breeding sexes, which reduces Ne and contributes to a high variation in individual reproductive success. Extreme fluctuations in population size, due to the effects of removals, can also act to reduce the value of Ne. Permanent contraception or removals that focus on older rather than younger animals result in a rapid decline in Ne (Singer and Schoenecker 2000; Coates-Markle 1999). Because Ne is so difficult to accurately assess, genetic monitoring should be conducted regularly for herds with populations near or below 150 animals.

Management practices that tend to increase Ne relative to population size include maintaining a sex ratio which favors males and a consequent large number of smaller harems, removals that concentrate on only the young animals, and introduction of two to three mares from another population with similar alleles (various forms of a gene) and higher genetic heterozygosity every nine to 12 years (Singer and Schoenecker 2000).

Obtaining information on the genetic diversity of a wild horse population typically involves the typing of a number of genetic marker systems from blood samples of individual horses in a herd. The measure of genetic diversity for the Centennial HMA was obtained from blood samples of 69 horses collected during gatherings conducted in 2001. Blood samples were analyzed by the University of Kentucky Equine Blood Typing Research Laboratory using seventeen genetic marker systems. The results were presented in a report by Cothran (2001). The following summarizes key aspects of the report as they pertain to the genetic diversity of horses in the Centennial HMA:

- The highest genetic similarity of the Centennial herd is with the North American Gaited Breeds followed by the Oriental and Arabian Breeds.
- Genetic variation within the Centennial herd is low but not critically low. Observed heterozygosity was reported at 0.325, which is lower than the feral horse mean (0.360) but still above 0.310, the proposed critical threshold.
- The herd exhibits a large number of low frequency variants which is suggestive of a mixed origin of the herd, perhaps with a small number of recent introductions.
- There appears to be a limited influx of outside genes in recent times and that genetic variation in the herd could be declining.

The herd should be monitored carefully due to the low amount of genetic variability. Heterozygosity is still above the proposed critical threshold but could fall below this level quickly if the population size drops below minimum recommended levels (i.e. an effective population size of 50 animals). The high proportion of variants at low frequency makes this herd especially vulnerable. Genetic variability is affected by almost all herd management decisions and its loss could reduce the overall health and fitness of the herd over the long term. Maintaining genetic variability will be accomplished by:

- Conducting genetic baseline sampling every generation (ten to fifteen years) and more frequently if there is a recognized concern regarding low genetic diversity.

- Ensure DNA testing is done through accredited equine genetic specialists such as Texas A&M University using hair samples. Ensure a minimum sample size of 25 animals (BLM 2009b).

- Consider the introduction of 2 to 5 young mares from other suitable herd areas every generation as needed;

- Continue the removal of young animals;

- Modify the sex ration by increasing the number of male horses and therefore the number of possible harems.

3.2.3 Management Strategies

A series of management options have been developed that incorporate the variable components discussed above and explore various combinations of ways the Centennial Herd could be managed within the established AML of 100 to 168 animals (see section 3.2.4.1).

Various potential option were investigated based on scientific literature and referrals from experienced wild horse and burro managers. These potential options were modeled using the WinEquus software created by Dr. Stephen Jenkins of the Department of Biology, University of Nevada at Reno. This population model was designed to help wild horse and burro specialists evaluate the different management options under consideration for a given herd.

The Jenkins model uses average survival and foaling rates by age class to project the population growth for animals between 0 and 20 years based on an initial description of the herd's age and sex distribution. Year to year variation in demographic patterns is accounted for by using a randomization process to select survival probabilities and foaling rates for each age class from a distribution of values based on these averages. Due to this variation, each trial of a management scenario will present a different pattern of population growth depending on the distribution of "good" years, when the population will grow rapidly, or "bad" years. The software runs at least one hundred trials for each management scenario to determine a median probable outcome. These median figures were then used to provide a cost assessment for each management option.

Management tools such as Gate-Cut versus Selective Removal gathers, fertility control, and sex ratio variation can be incorporated into the model.

Factors that are constant in all the management options are:

- Herd size – 532 (approximate)
- Sex Ratio – 53% Male:47% Female
- Foaling Rate – 45% (approximate)
- Mortality Rate – 5% (approximate)
- Gather rate – 80% (maximum)

- AML – 100 Lower Limit, 168 Upper Limit.

The herd size of 532 was derived from the 2010 census flight which counted 459 horses. It was assumed that factoring in animals missed plus the 2011 foal crop after some death loss would yield a population of around 532 in the fall of 2011. There is some speculation that some animals may have been double counted during the survey, however for the purpose of this document the full census was used.

Actual foaling rate data was not available for the Centennial herd; however, Navy and BLM sources indicated that the herd exhibited an average growth rate of 16 percent. Based on a 95 percent rate of survival and a sex ratio of 53:47 this would yield an average foaling rate of 53 percent. The Jenkins model requires a breakdown of foaling rates by age group. Since this information was not available for the Centennial herd, census data from a similar herd (Pryor Mountain HMA) were used.

Mortality rates were unavailable for the Centennial Herd, so a standard rate of five percent was used.

The gather rate of 80 percent was based on experience with smaller gathers of the Centennial Herd over approximately 20 years (Nunn 2009, *pers. comm.*) and the large-scale gather conducted in 1995 when 88 percent of the herd was successfully gathered. This is the reasonable maximum percent of the herd that can be gathered during a given year.

The AML is discussed in Section 3.2.2.1.

Factors that are variable in the management Strategies are:

- Removal – Gate Cut vs. Selective – Discussed in Section 3.2.2.4
- Fertility Control – Discussed in Section 3.2.2.5
- Sex Ratio – Discussed in Section 3.2.2.6
- Gather Frequency

Please see Appendix A for a complete description of modeling parameters and results.

While numerous management scenarios were considered and tested, only four management strategies were selected for presentation in this Plan. These management options present various combinations of the herd management variables listed above.

3.2.3.1 Management Strategy 1 - No Change in Current Management Practice

Management Strategy 1 is a continuation of management practices currently in existence. In this scenario approximately 43-63 (depending on cost per animal) adoptable animals are removed from the herd each year. Removal is accomplished through selective roping from horseback with the aid of a helicopter to haze horses to ropers. The number of animals removed is dependent on the availability of funds. Currently, approximately $95,000 is spent every year on removal of wild horses and burros. With a gather cost per animal of $500 and an adoption cost per animal of $1,700, this equates to 43 animals removed. (Gather and adoption costs range from $1,500 to $2,200 per animal). This management Strategy does not adequately

control the growth of the herd. The herd will continue to grow, moving further and further away from AML. After 11 years the herd could exceed 1,600 animals.

Selective roping has been a preferred technique due to its simplicity and perceived cost effectiveness. Cost is incurred on a per-animal roped basis, and only adoptable animals are selected and removed. This means that no long term holding costs are incurred and no complicated logistics are involved in the removals.

As selective roping is not compatible with the WinEquus model, population increase was calculated by hand using the following assumptions:

Initial herd size – 532 animals Animals removed per year – 43 Growth Rate = 16%

The calculated results are as follows:

- Average Growth Rate =16%
- Population size after 11 years = 1616
- Total Animals Gathered = 473
- Total Animals Removed = 473
  - Removed two-year-olds and under = 473
- Projected ten-year cost = $1,040,600
  - Projected Annual Cost = $94,600

3.2.3.2 Management Strategy 2 – Gate-Cut Gathers to Achieve AML

Management Strategy 2 is a gate-cut gather every two years in which a portion of the herd is gathered and removed in order to bring the population down to the lower range of the AML (100 animals). In this scenario, unadoptable animals that are gathered and removed are sent to long-term holding facilities or sanctuaries. This Management Strategy achieves lower AML within the first gather cycle. Gathers would only be conducted if the herd population exceeds 150 animals. Under certain conditions this could lead to a longer gather cycle. (For example, if the herd did not exceed 150 animals the gather would be postponed an additional two years.)

Gate-Cut gathers have long been used due to their ease and simplicity. Only a portion of the herd must be gathered and removed in order to reach AML. The problems with this gather method are the amount of animals sent to long term holding facilities or sanctuaries (287 horses in the scenario) and the significant loss of genetic variability resulting from the removal of entire family groups (Singer and Schoenecker 2000).

While Management Strategy 2 achieves AML during the first gather cycle, which is important for the ecological health of the rangeland, it is the most expensive Management Strategy studied and would negatively impact genetic variability. This is due to the continued high growth rate of the herd and the large number of animals placed in long term holding.

The projected results from the WinEquus model are as follows:

- Average Growth Rate (Median) = 12.6
- Population size after 11 years (Average) = 179
- Total Animals Gathered (Median) = 502
- Total Animals Removed = 426
  - Removed two-year-olds and under = 159
  - Removed three-year-olds and over = 287
- Projected ten-year Costs = $2,243,300
  - Projected Annual Cost = $203,936

3.2.3.3 Management Strategy 3 – Immediate Reduction with Selective Removal and Fertility Control to Achieve AML

Management Strategy 3 implements an 80 percent gather on a four-year cycle. The first gather is a comprehensive removal to reach lower AML, followed by selective removals of only animals younger than three years old. All mares not removed are treated with 22 month PZP. During the first gather, a significant number of unadoptable animals are removed and sent to long term holding facilities or sanctuaries in order the bring the herd within AML. This incurs a significant but one-time expense since no unadoptable animals are removed in the consecutive gathers.

Removal of the older, unadoptable animals is necessary to reach AML quickly. This quick reduction produces an ecological benefit by bringing the herd within AML and results in an immediate decrease in management cost. The herd would lose a significant amount of genetic variability resulting from the removal of over half the herd (55%).

Management Strategy 3 differs from Management Strategy 2 as it uses a full gather of the herd every four years and fertility control to reduce the growth rate of the herd.

The projected results from the WinEquus model are as follows:

- Average Growth Rate (Median) = 7.7
- Population size after 11 years (Average) = 122
- Total Animals Gathered (Median) = 630 (359 in first gather)
- Total Animals Removed = 347 (293 in first gather)
  - Removed two-year-olds and under = 123
  - Removed three-year-olds and over = 224 (all from first gather)
- Total Animals Treated = 79
- Projected ten-year Costs = $1,887,850
  - Projected Cost of First Gather = $1,640,800
  - Projected Annual Cost for Following Gathers = $30,900

3.2.3.4 Management Strategy 4 – Selective Removal with Fertility Control

Management Strategy 4 uses an 80 percent gather on a three-year cycle with selective removal and fertility control. Only animals less than three years old are removed for adoption. Because of this stipulation, the

herd approaches AML much more slowly than Management Strategies 2 and 3, and may not reach AML for 20 years or more. All mares not removed are treated with 22 month PZP.

The benefits presented by Management Strategy 4 are the elimination of the use of long term holding facilities, preservation of genetic variability since no family groups are removed, and the greatly reduced growth rate of the herd. The three-year gather frequency allows for the greatest efficacy of fertility control without the risk of sterilization. Once AML has been reached, the herd manager could increase the gather frequency or reduce the number of mares treated with contraceptives.

The largest cost associated with this Management Strategy is gathering. This management method is essentially eliminating the growth rate of the herd and waiting for attrition. Once the herd is brought within AML, management costs could be less than $35,000 per year.

The projected results from the WinEquus model are as follows:

- Average Growth Rate (Median) = 3.0
- Population size after 11 years (Average) = 482
- Total Animals Gathered (Median) = 1328
- Total Animals Removed (Median) = 371
  - Removed two-year-olds and under = 371
  - Removed three-year-olds and over = 0
- Total Animals Treated (Median) = 318
- Projected ten-year Costs = $1,374,200
  - Projected Annual Cost = $124,930

3.2.3.5 Comparison of Management Strategies

Table 3.5-1 provides a summary and comparison of the Management Strategies presented above.

Table 3.5-1. Herd Management Strategies Summary

	Strategy **1**	Strategy **2**	Strategy **3**	Strategy **4**
Gather Type	8% Selective Roping	Gate-Cut to reach AML	>80%	>80%
Gather Frequency	Annual	2 years	4 years	3 years
Selective Removal	Yes	No	2 years and under only after first gather	2 years and under
Fertility Control	No	No	Yes	Yes
Sex Ratio	53:47 (females)	53:47 (females)	53:47 (females)	53:47 (females)
Projected 10 yr Cost	$1,040,600	$2,243,300	$1,887,850	$1,374,200

3.2.4 Conclusion on Analysis of Management Strategy for Wild Horse Management

The current management practices (Management Strategy 1) for the Centennial Herd at China Lake are not sustainable financially or ecologically. The small helicopter and selective roping gathers currently in practice do not sufficiently reduce the growth rate of the herd. Without change, the herd size will continue to grow rather

than be reduced to meet AML. Without a change in management, the Centennial herd could be larger than 1600 animals by 2022. These incomplete (8%) gathers do not allow for the use of fertility control treatments which can slow or stop the growth rate of the herd. However, Management Strategy 1 should continue to be used to do selective roping on short budget years so that something is accomplished every year.

Management Strategy 2 (Gate-Cut Gathers to Achieve AML) demonstrates that the herd cannot be effectively managed through removals only. Due to the size and growth rate of the herd and the high cost of removing unadoptable animals, a new strategy is needed. In order to bring the herd within AML, the growth rate of the herd must be greatly reduced or large numbers of unadoptable animals must be removed from the herd. Management Strategies 3 and 4 provide more economical and sustainable mechanisms for reducing the growth rate of the herd and reaching AML, but on drastically different time frames.

Management Strategy 3 (Immediate Reduction with Selective Removal and Fertility Control to Achieve AML) uses a dramatic and very costly removal of animals during the initial gather in order to bring the herd within AML. After this first removal the herd can be easily and cost effectively managed using regular 80 percent gathers, removal of only adoptable horses, and fertility control. While immediately achieving AML is desirable for many reasons, it may be difficult due to BLM restrictions on the number of animals placed in long-term holding facilities. Navy funding priorities may also not be sufficient to cover the high costs associated with placement of animals into the sanctuary system.

Management Strategy 4 (Selective Removal with Fertility Control) does not allow for the removal of unadoptable animals. Through the use of fertility control via 22 month PZP and removal of horses two years old and younger the growth rate is brought to three percent (which is lower than the five percent annual death loss). As animals die off they are not replaced and the herd slowly decreases until reaching AML after approximately 20 years. The projected annual cost of Management Strategy 4, at approximately $30,000 more than the current annual expense of $95,000 is the most economical of the Management Strategies studied.

By implementing a PZP-based fertility control program the growth rate of the herd can be managed in a cost-effective and humane manner. The decision of whether to remove older animals to bring the herd within AML or to halt the growth of the herd and allow it to slowly decline will depend on the availability of long term holding facilities, availability of financial resources, ecological and safety considerations, and politics.

Fertility control technology has contributed to making this management procedure possible. However, diligence must be exercised to assure funding for the procedures as scheduled. The intricate and sensitive nature of fertility control dictates the need for consistency and reliability. For example, fertility treatment with controlled release formula PZP provides infertility at 94 percent for Year 1, 82 percent for Year 2, and 68 percent for Year 3. Fertility returns to normal on the fourth year (Bartholow 2004; Turner *et al*. 2005). Given these limitations, the large initial investment of time and resources required to bring the herd within AML will be lost if funding is withheld. The consequence will not be solely lost time. The cost increases exponentially as fertility returns to normal and horse populations return to doubling their size every four years. Without consistent and thorough implementation (>80% gather every three years), the fertility control program will not be able to effectively control the growth rate of the herd, and management costs will increase.

The Centennial Herd population is now at 532 animals. It is not possible to get this herd down to AML (100 to 168) without the use of fertility control to restrain the annual herd recruitment. A license must be applied for to use fertility control, and a commitment must be made to do initial and follow-up treatments on a systematic schedule. In order to use this technology, the Centennial Herd management budget will have to become sufficient and reliable.

Management Strategy 3 provides a substantial reward for getting through the initial cost and effort to stabilize the herd. The projected annual cost for maintaining the herd once AML has been reached is less than one half of the cost of the other Management Strategies – roughly an average of $35,000 per year.

BLM adoption statistics (BLM 2007) indicate that animals over two years of age have only a 33 percent adoption rate. Management scenarios that rely on removal of these animals are highly dependent on the use of long-term holding facilities or sanctuaries. In the event that long term holding facilities are not available, Management Strategy 4 would be the next preferable Strategy. Under Management Strategy 4, the herd will not reach AML within the first ten to 15 years. As the herd size slowly decreases, pressure on natural resources will ease. The cost of gathering will decrease with the population size and, once the herd reaches AML, the cost of maintenance will be the same as for Management Strategy 3.

The selection of a particular management strategy in any given year may be dependent on: the need to conduct a roundup; the timing (season) during which gathers may need to take place; funding availability; access restrictions to gather sites; ability of BLM to gather, process and adopt animals; and the availability of sanctuaries for older horses. The selection of which management Strategy selected will be closely coordinated with the BLM to ensure suitability and practicality. Due to the large number of variables it is not currently possible to precisely determine which strategy will be employed over the next few years.

Genetic monitoring is highly recommended for the Centennial Herd regardless of the management Strategy selected. Genetic marker analysis can be conducted using hair samples collected from twenty-five animals or 25 percent of the post-gather population (BLM 2009b). This analysis should be conducted every two to three gather cycles. If analysis indicates a drop in genetic variation, management methods should be reevaluated and the introduction of mares from similar herds may be necessary. Dr. Gus Cothran, currently of Texas A&M University, facilitates the BLM genetic testing program and can provide analysis and reporting for the Centennial Herd. Please see Appendix H for the BLM instructions on sample collection, handling, and processing.

3.3 BURRO POPULATION CONTROLS

The vicinity of NAWS consisting of the NPS, NTC Fort Irwin, NAWS-CL, and the intermingled BLM lands has provided habitat for burros for several decades. An AML of zero for burros was set in 1981 and 1983 by amendments of the CDCA. Since that time, several thousand burros have been removed from the region with the intent of accomplishing AML, with limited success. The burros are well adapted to the Mojave Desert and successfully compete with native fauna. Their impacts are:

- Delaying or precluding recovery of vegetation and soils (even at low numbers)
- Conflicting with other wildlife (including but not limited to bighorn sheep)
- Loitering at (so affecting the presence of other wildlife) and fouling water sources

- Destroying piping and wildlife drinkers (game bird guzzles)
- Damaging archeological resources
- Damaging critically important springs and riparian areas that are depended upon by many special status species
- Interfering with equipment and potentially causing delays in military mission activities.

Burros removed from NAWS-CL, are replaced by immigrants from Death Valley National Park, NTC Fort Irwin, and adjacent BLM lands. NTC Fort Irwin has become the largest source of animals with the largest reservoir of stock of all the neighbors (DiGrazia 2009, *pers. comm.*). Fortunately, most areas on the South Range are well suited for capturing burros and it is used regularly for that purpose. Figure 3.3-1 shows a burro run trap and a host of staging areas for roping them.

The current removal process has been somewhat effective at removing burros from NAWS and adjoining lands. However, sufficient funding is not always available to each land manager each year. As a result burros are not annually removed from the entire region on a yearly basis. Remaining burros continue to cross property lines and rapidly re-establish themselves in previously cleared areas. The current situation could go on indefinitely with the agencies not move any closer to achieving their mutual zero population objectives and continuing to incur costs and habitat damage indefinitely. A coordinated and cooperative plan could achieve the mutually beneficial management objectives and zero-population goal once and for all. First, the plan should provide for an effective census to determine the number of burros and where they are located. Second, the plan should detail the ways, means, and schedule that will be used to cooperatively accomplish the zero burro AML. Based on previous efforts, if simultaneous gathers can be completed on adjacent lands it is anticipated that annual cost to control China Lake burro numbers would be approximately $100,000 dollars for each of the first three years and be significantly less in subsequent years. Subsequent burro removal efforts would be limited to a maintenance program that would locate and remove burros missed in the initial three year effort.

3.4 HABITAT MANAGEMENT

3.4.1 Spring and Riparian Protection and Management

3.4.1.1 Springs

Numerous springs exist on the North and South Ranges, some exhibiting considerable flow and reliability. The challenge is to keep water available for drinking, with the spring sources themselves remaining undisturbed by the wild horses and burros.

Spring areas provide fresh water, lush green riparian vegetation, and a cool shaded environment. Wild horses and burros enjoy pawing and standing in water sources of all kinds. They congregate in the undeveloped and unprotected springs, overgraze the area, and foul the water. Also, the pawing and trampling can seal off springs so water supplies are depleted or eliminated. Ironically, wild horses can and often do travel long distances, passing existing water sources along the way, to get to a preferred water source. Trailing to and from water can present challenges in managing grazing unless periodic rest and recovery is provided for the plant life near the water sources. A well-designed and carefully constructed spring development can be the best way to supply water to accommodate wildlife including wild horses and burros.

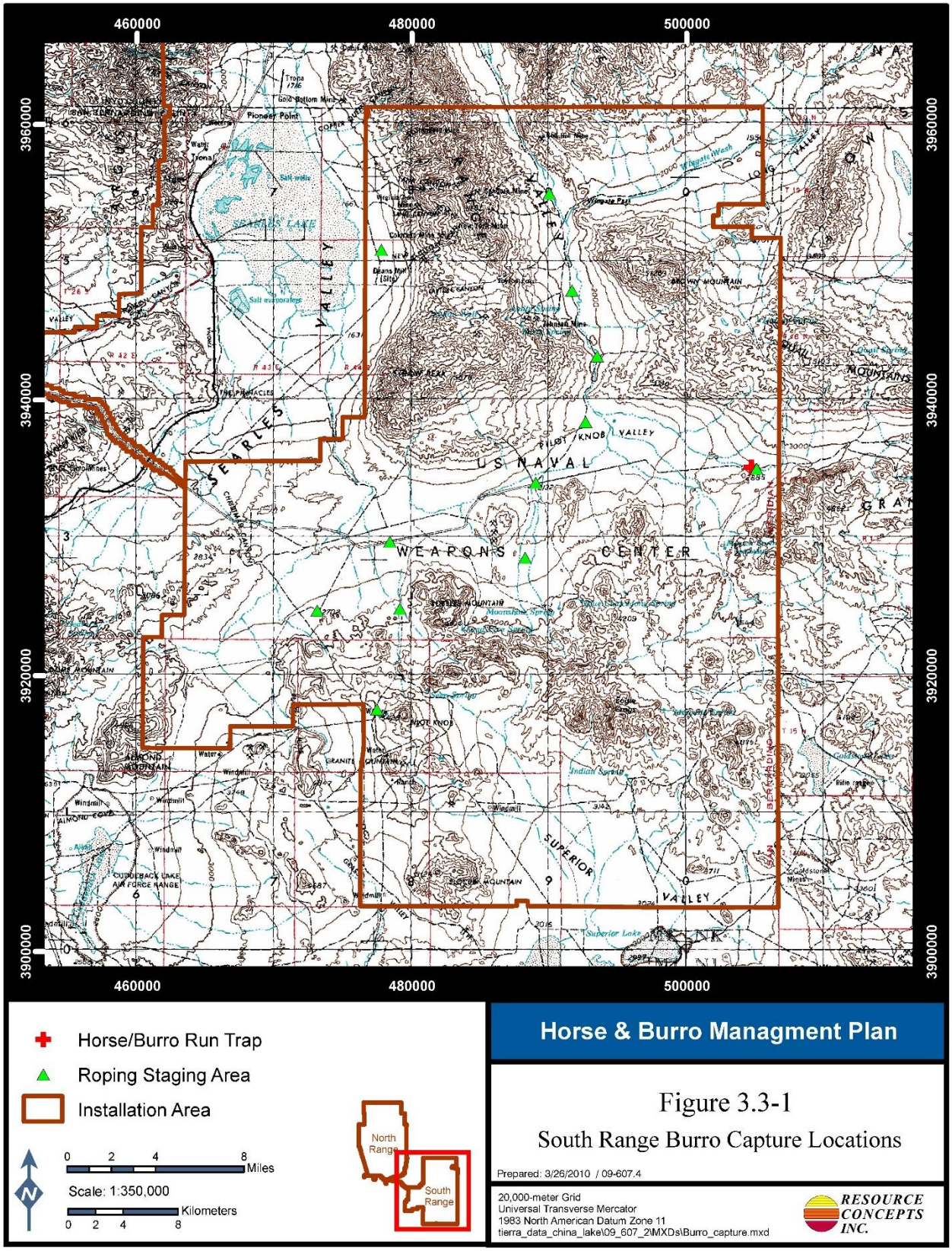


Figure 3.3-1 South Range Burro Capture Locations

Springs and seeps are essential to life in desert environments. Therefore, care and protection of springs and related vegetation is critically important for the NAWS-CL and should be given high priority. Wildlife, including deer and desert bighorn sheep, occur throughout the NAWS-CL. They are as dependent upon the springs and riparian vegetation as the equines. An extraordinary number of chukar also frequent the springs and are prospering.

Spring developments require experienced professional on-site evaluation and careful design. When determined to be appropriate, springs should be developed using an approach such as the USDA Natural Resources Conservation Service (NRCS) design, (see Appendix C) or a similar design. Proper measures and protected spring areas can enhance flow rates and reliability. This is particularly true during drought periods. As a general rule, a pipeline should be extended away from the spring box for a planned distance to a dry upland site where a water trough can be located. This will keep animals out of the drainage and on dry ground, lessening the impact of animals in the drainage way. On the other hand, a sandy wash may be well suited for a trough if it can be placed in a manner so it is not susceptible to flash flooding. The pipeline can be extended to accommodate more than one trough if the flow is sufficient. Properly installed, this approach can help re-distribute horse use areas and relieve stress in habitats where animals congregate for water.

Exclosures can be constructed around springs and riparian areas for further protection. NAWS-CL has done this for a number of springs using wildlife friendly, steel fence panels designed in cooperation with the California Department of Fish and Game. Panels are manufactured by Powder River Company in Utah. The value of this protection is reflected in the flows and quality of those springs that are presently fenced with this product. Although the product may be more costly than standard fencing, it is easier to install and will last indefinitely if properly maintained. In addition, the panels will withstand wildfires, which are a constant threat, whereas standard barbed wire fences do not fare well under wildfires. Wooden braces and corner posts burn readily and require maintenance. The steel panel design for spring developments is a marked improvement over typical barbed wire fencing and allows for wildlife access, including bighorn sheep, to vegetation while excluding wild horses and burros. The wild horses and burros are then forced to use the areas below the spring or an installed water trough to obtain water. A small pond can be constructed below the exclosure to intercept flow and provide a reliable supply. Limited water supply often encourages pawing disturbances by wild horses and burros. Fencing of springs can sometimes be designed so the availability of water can be controlled. When that is possible, periodic rest from grazing can be provided to the upland vegetation surrounding the exclosure.

Water troughs are a critical component of a well-designed spring development and come in a variety of designs and materials. Steel tanks are generally most dependable unless vandalized. Redwood tanks are also dependable as long as water remains in the tank year round. If vandalized with bullet holes, for example, redwood is easily plugged for simple repairs. If winter temperatures at the higher elevations result in water freezing, then it would be judicious to install a durable tank cover over two-thirds of the tank and bury that part of the tank into a hillside, leaving a portion exposed for watering. With the earthen fill material as insulation, the water will typically remain open year-long as a reliable source, unless winter temperatures reach sub-zero for a period of time.

3.4.1.2 Riparian Areas

Riparian areas include springs, streams, seeps, artesian wells and meadows where the vegetation is strongly influenced by the presence of water (Chaney, Elmore and Platts 1990). Riparian areas on NAWS-CL include 120 or so springs and certain seeps. Detailed examination of several of these springs was conducted on field visits to assess intensity of use by wildlife, horses and burros.

All wildlife depend on these areas, and this creates a serious conflict. Riparian areas are appealing to animals because of the abundance in vegetation, shade, shelter and water, which leads to overgrazing by wild horses and burros. The Inyo California towhee, a federally listed threatened bird species, occupies certain seep/spring areas of NAWS-CL. Critical Habitat for towhees is centered on springs and riparian areas plus nearby upland areas, and is depicted on Figure 2.1-6. Protection and enhancement of their habitat is a priority in the NAWS-CL INRMP and under the Endangered Species Act.

Relatively small riparian areas can be fenced easily for protection and can be treated with the same methods as those described in Section 3.4.1.1. It is difficult to protect or manage large riparian areas without pasture fencing, which is necessary to provide periodic rest from grazing by rotating the wild horses and burros over large areas. This makes the Centennial HMA a challenge because pasture fences are prohibited in wild horse and burro management areas. They are prohibited on the basis that the animals must be allowed a wild and free roaming existence (BLM 1971).

Aside from fencing the springs, the existing management program is quite possibly the best that can be provided for other areas of riparian vegetation since they are grazed by a wild horse population that is allowed free roaming status by law. The grazing pressure has been significantly reduced with major wild horse and burro reductions and elimination of cattle. Also, the small and well-dispersed horse bands further reduce grazing pressure and allow for plant recovery.

3.4.2 Wildfire Hazards and Fuels Management

Vegetation community diversity on NAWS-CL is apparent when ascending from valley floor to mountaintop. The condition and trend of the vegetation appeared generally favorable overall. However, biomass accumulation was apparent, albeit in a dry condition as a result of ongoing drought. The biomass buildup over time, and the effects of drought, combines to present a growing wildfire hazard.

Fire plays an important role in natural environments. However, unnatural conditions, including the introduction and spread of invasive, highly flammable species such as cheatgrass and red brome (*Bromus tectorum* and *Bromus madritensis* ssp. *rubens*), have changed the role of fire considerably (Great Basin Wildfire Forum 2008). The West is now subjected to unprecedented wildland fire size and vegetation type conversion. NAWS-CL, which receives fire ignitions from lightning as well as from military testing and training, has an emerging wildland fire concern.

The abundance of burn scars on NAWS-CL demonstrates the wildland fire hazard. Cheatgrass and red brome are opportunists that quickly establish following wildfires, and further exacerbate the fire hazard by shortening the fire return interval. In addition, they provide the continuity of fuels that increases the rate of spread of wildfires in degraded big sagebrush/bunchgrass communities (Young and Clemments 2009). With successive wildfires, an area can rapidly convert to a monoculture of cheatgrass and red brome, which changes the fire regime from typical 25-50 year occurrences to a three- to five-year return interval.

A sizeable area of dead and dying sagebrush was observed in the vicinity of an existing vegetation transect at Cole's Flat. The interspaces were beginning to fill with more drought resistant species that favor the hot desert environment. This would need to be further investigated to determine the cause of the change. Pinyon pine (*Pinus monophylla*) stands may also be increasing in density, as they appear overstocked in the area immediately west of Coso Peak. These trees increasingly compete for available water and nutrients as the density increases. Droughts exacerbate this condition and weaken the trees making them more vulnerable to the Ipps beetle, sawfly, and various diseases that can spread rapidly and cause mortality. Dense stands of trees contribute to the risk of large wildfires as have occurred throughout the west over the past two decades. In contrast, pinyon pine researchers have verbally indicated that this woodland type will potentially be reduced by 50 percent over the next three to four decades and be nonexistent by the end of the millennium due to climate change (Tausch 2009, *pers. comm.*). Thinning treatment may extend the existence of these woodlands for some time beyond the projected timeframes, and allow for wildfires to pass through the trees without eliminating the stands. At the same time, more open stands allow higher water use efficiency for the stand and healthier trees left behind.

The increasing standing biomass coupled with drought and repetitive wildfires could result in rapid vegetation change toward a monoculture of annual, highly flammable invasive species. Some evidence of this dilemma can already be seen in recent burnt areas. Current vegetation conditions are judged generally suitable for the horse herd and wildlife. However, with the canopy growth of shrubs, trees, and fine fuels over parts of the area, the threat of large, destructive wildfire could change that. Dense shrub and tree stands typically burn especially hot. This can destroy the native plants and seed banks, sterilize soils, and sometimes create hydrophobic soil conditions. Under this scenario, the only alternative is to re-seed. However, the risk of seeding failure is increasingly high because of drought, climate change, the normal low precipitation of the region and the presence of exotic vegetation such as cheat grass.

To reduce wildfire risk, it would be beneficial to conduct a wildfire risk/hazard assessment and develop a risk reduction and fuels management plan, which would identify areas of highest risk and treatment alternatives. Treatment would encourage cooler burning, less damaging fires, and confine fires to smaller, more manageable blocks. In addition, this plan could provide strategies for protecting important cultural resources such as historic mine sites, homesteads, and remote facilities.

While not directly related to wild horse and burro management, the increasing threat of large wildfire events pose a threat to resources, wildlife, and wild horse populations. The threat should be given attention and mitigated with preventative actions beforehand.

3.4.3 Habitat Monitoring

3.4.3.1 Summary of Existing Approaches

The existing habitat-monitoring program for the NAWS-CL North Range represents a continuation of a vegetation trend-monitoring program initiated in 1986 by the BLM for administration of the LCM Allotment. As reported in BLM (1995), the BLM originally established and monitored a total of 21 permanently located and repeatable Quadrat Frequency Method transects at key upland areas located in the LCM Allotment. Other studies conducted at these key area monitoring sites included Point-Intercept basal (i.e., ground) cover and the Key Forage Plant Method (now called the Key Species Method) to record forage utilization at each site.

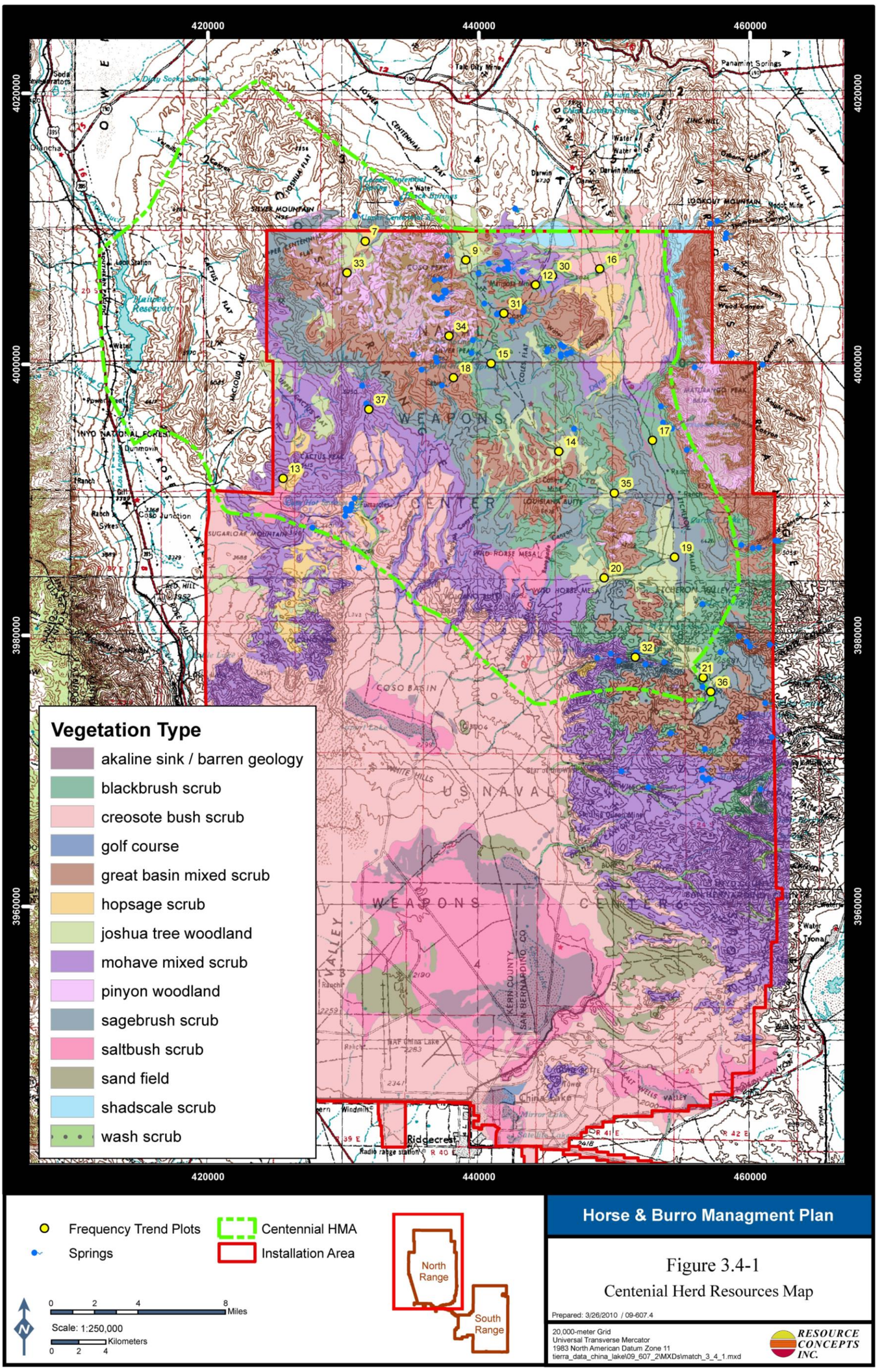
The purpose behind these BLM monitoring studies was to determine whether current grazing practices were meeting the identified resource objectives by tracking changes in plant frequency or occurrence and ground cover over time. Twelve of these BLM key area monitoring sites, identified by site numbers 7, 9 and 12 through 21, were located within the confines of the NAWS-CL North Range and the Centennial HMA (Figure 3.4-1). While the available records were incomplete for these twelve monitoring sites, the 1995 allotment evaluation indicates all 12 study sites were sampled by the BLM at least twice during the interval of 1989 through 1994, with four sites incurring three monitoring readings during this interval.

After the cessation of permitted cattle grazing in 2000, NAWS-CL contracted with Epsilon Systems Solutions, Inc. to repeat the vegetation trends studies previously established by the BLM in the North Range and to establish eight new vegetation trend-monitoring sites to replace those lost by virtue of being located outside of the NAWS-CL (Epsilon 2006). Identified by site numbers 30 through 37, five of these replacement monitoring sites were located in upland sites in close proximity (i.e., 100 to 500 feet) of perennial riparian areas (e.g., Sites 30, 31, 32, 36 and 37). The remaining three sites were located in upland sites (Figure 3.4-1).

As reported in Epsilon (2006), the intent of the authors was to duplicate the field sampling methods previously employed by the BLM at the 12 monitoring sites located within the North Range over two consecutive years (i.e. 2005 and 2006) for the purpose of comparing these recent results with those reported by BLM (1995).

Detailed results of the two studies are summarized and compared in the Range Assessment Survey Report for the Lacey-Cactus-McCloud Allotment (Tierra Data Inc. [TDI] 2011). In addition, TDI conducted a range assessment in 2010. The 2010 range assessment was a continuation of the monitoring program established on the Lacey-Cactus-McCloud grazing allotment by the BLM in 1986. The field attributes used to assess grazing practices were (1) change in the relative abundance of perennial forage plants in representative areas of the allotment compared to what would be expected; (2) the amount of ground cover compared to what would normally be expected for the site; and (3) grazing utilization of key forage plants. For examining the cover and mix of perennial plants and ground cover, monitoring methods consist of the Quadrat Frequency and the Point-Intercept methods. For estimating utilization of forage by grazing animals, the Key Species Method is used. These methods were employed by the BLM in 1993, Epsilon Systems Solutions in 2005 and 2006, and Tierra Data Inc. in 2010. Results in 2010 were not detectably different from previous years in most cases. The reported frequency occurrence of most perennial plant species from past data sets fell in the extreme tails of the statistical distribution described above, and for this reason an adjusted quadrat frame was created and used for the current work. This had been a recommendation of an early draft of this Wild Horse and Burro Management Plan (RCI and TDI 2011). TDI included the previously-used 20”x 20” quadrat nested within a 30”x 30” frame for the 2010 sampling to examine if an increased quadrat size produced more representative frequency results.

Seedlings were not recorded separately during any of the data collection years at NAWS China Lake. The ecological importance of seedling establishment and its significance in rangeland recovery should be considered when planning future sampling. The lack of reporting on whether some of the frequency data included seedlings precludes the manager’s ability to interpret whether change is due to rainfall year versus actual change in plant status. It is important for managers to be able to assess whether grazing has precluded the establishment of perennial seedling, in a system where significant recruitment of new individual may occur only once in a decade or more.


420000
440000
460000
4020000
4000000
3980000
3960000
Vegetation Type
akaline sink / barren geology
blackbrush scrub
creosote bush scrub
golf course
great basin mixed scrub
hopsage scrub
joshua tree woodland
mohave mixed scrub
pinyon woodland
sagebrush scrub
saltbush scrub
sand field
shadscale scrub
wash scrub
Frequency Trend Plots
Springs
Centennial HMA
Installation Area
North Range
South Range
0 2 4 8 Miles
Scale: 1:250,000
0 2 4 Kilometers
Horse & Burro Managment Plan
Figure 3.4-1
Centenial Herd Resources Map
Prepared: 3/26/2010 / 09-607.4
20,000-meter Grid
Universal Transverse Mercator
1983 North American Datum Zone 11
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The frequency-based approach to assessing trend is intended as an early warning method for adjusting stocking rates or grazing systems to allow vegetation to recover. Unless measured regularly and consistently, frequency data represents snapshots in time which cannot be compared to draw conclusions about trend. Improved documentation and correction of methods in recent field work will hopefully alleviate future problems. Point-Intercept data collection should follow a consistent sample size and should follow the technique prescribed by the BLM (1985), as these were how the plots were designed.

While the past focus of monitoring was on production of livestock products as the primary value, a broader suite of questions needs to be addressed today. It is recommended that NAWS China Lake consider the value of employing more up-to-date models and methods of assessing overall rangeland health in order to achieve a better understanding of ecological functions of the natural habitats present, while not compromising the value of the existing historic plots since they do provide the only basis for trend across the historic allotment area. Grazing management decisions for wild horses and burros, now that the livestock are gone, are not strongly defensible based on these plots alone, and there are other uses and values on the land to consider outside of grazing.

This could be accomplished by an annual program that maintains the existing plots sampled every three to five years. In other years, a monitoring program would focus on disturbance recovery. Disturbances should include fire (using burned/unburned paired plots, recovery from grazing at water sources, and grazing recovery near exclosures (also using paired plots). Existing exclosures are at Etcheron Valley and at Lost Cabin.

An expanded and more focus sampling program is being developed for implementation in the 2014-2015 timeframe. This data will be used to assess rangeland health, forage production, and vegetation/habitat recovery. Study sites will be located at springs and seeps, nearby heavily utilized upland areas and lighter use areas away from water sources. This data will provide long-term vegetation production and recovery trend data and will be used to assess the need to adjust horse herd numbers. This same data may also be used to support the need to adjust herd distribution by developing or enhancing water sources in currently underutilized areas.

3.4.3.2 Review Findings

The current monitoring methods applied in the North Range (i.e., Quadrat Frequency, Point-Intercept, and Key Species Methods) represent sound and cost-effective methods for monitoring vegetation trends and forage use levels at strategically placed locations (i.e., Key Area sites). The Quadrat Frequency Method offers the advantage of providing sufficient data collection at each study site to allow statistically reliable comparisons across data sets. Of primary importance to maintaining the reliability in trend monitoring of this nature is assuring the applied field methods remain consistent between sampling intervals. To maintain a high level of consistency requires the development of a formal monitoring plan that documents and institutionalizes the applied monitoring methods and locations for established monitoring sites.

In review of the habitat monitoring information provided by BLM (1995) and Epsilon (2006) some questions and inconsistencies were noted as reported below. Some of these review points likely result from the undocumented nature of the monitoring methods previously employed by the BLM. Accordingly, these observations may or may not represent material errors in the monitoring results reported in either BLM (1995) or Epsilon (2006).

- Based on the inherent spatial characteristics of the plant community or habitat type being monitored by Quadrat Frequency Method, the size or dimensions of applied quadrat frame become critical because this single variable can directly influence the recorded occurrence of species present within the sampled

plant community. For this reason, BLM (1996) and Swanson *et al*. (2006) recommended the selected quadrat be sized to produce frequency percentages, for the dominant or important plant species, within the range of ten to 90 percent or, if possible, between 20 and 80 percent.

- BLM Technical Reference 4400-1 is referenced in BLM (1995) as being the methodology used to conduct frequency and cover studies in the LCM Allotment. When conducting Quadrat Frequency Method, this agency reference indicates the requirement to place lateral quadrat frequency transects at random locations along the baseline and with an equal number on either side of the baseline transect. A table is included in BLM (1985) which illustrates randomly selected lateral transect locations for study sites having either ten or 20 lateral transects. Over time, it has been a common practice for many BLM Districts to install new frequency trend transect studies using the random lateral transect locations illustrated in BLM (1985). This sampling approach can best be described as systematic-random sampling as opposed to completely random sampling practiced by Epsilon (2006) in the quadrat frequency sampling conducted in both 2005 and 2006. The added variability that is associated with the random sampling design used by Epsilon (2006) may in part explain the variable plant frequency results obtained between the 2005 and 2006 sample years.

To evaluate the spatial distribution of the 20 existing monitoring sites in relation to the principle plant communities located within the Centennial HMA, RCI overlaid the study site UTM coordinates reported by Epsilon (2006) on the vegetation mapping provided in the NAWS-CL Integrated Natural Resources Management Plan (U.S. Navy 2000) (Figure 3.4-1). As summarized in Table 3.4.3-1, this analysis indicated a minimum of two existing monitoring sites were located in each primary vegetation community that represented ten percent or more of the area in the Centennial HMA. The exception to this conclusion was the Creosote Bush Shrub plant community, which does not currently contain an established monitoring site and occupies approximately 14.2 percent of the Centennial HMA. This observed level and distribution of trend monitoring sites within the NAWS-CL North Range is similar and comparable to the intensity of vegetation monitoring conducted on many grazing allotments administered by the BLM and is not considered particularly deficient.

Table 3.4.3-1. Occurrence of Habitat Monitoring Sites

Vegetation Type[1]	Area in the Centennial HMA		No. of Existing Monitoring Study Sites
	Acreage	Percentage (%)	
Alkaline Sink / Barren Geology	741	0.3	0
Blackbrush Scrub	33,814	14.3	2
Creosote Bush Scrub	33,782	14.2	0
Great Basin Mixed Shrub	41,666	17.5	4
Hopsage Scrub	4,581	1.9	2
Joshua Tree Woodland	16,745	7.0	4
Mojave Mixed Scrub	46,565	19.5	4
Pinyon Woodland	12,820	5.4	0
Sagebrush Scrub	37,542	15.8	3
Saltbush Scrub	4,326	1.8	0
Shadscale Scrub	1,018	0.4	0
Wash Scrub	4,606	1.9	1
Total:	238,206	100.0	20

[1] Vegetation type mapping based on the 2000 Integrated Natural Resources Management Plan for the China Lake Naval Air Weapons Station (U.S. Navy 2000).

Notwithstanding the suitability of these applied monitoring methods, they do have inherent limitations. The most notable limitation is the monitoring of plant frequencies and ground cover provides very little information on the current status of a plant community in terms of its ecological potentials. There are two commonly applied approaches for attaining habitat potential information. One approach involves comparing the current estimated plant composition against the reference ecological site descriptions developed by the USDA NRCS. Boundaries for ecological sites are identified through an Order 3 soil survey where soil mapping units are correlated to the natural plant communities adapted to each mapped soil unit. The characteristics and species composition for the potential natural plant communities are ascertained from comparable reference sites. An Order 3 soil survey was completed by the NRCS in a portion of the NAWS-CL North Range; however, the area included in this existing soil survey was limited to an area located immediately north of Ridgecrest, California, and did not extend north to include any portion of the Centennial HMA (NRCS 1984). Due to the spatial limitations associated with this completed soil survey, the upfront costs for collecting the initial field inventory information to designate ecological sites and develop the corresponding ecological site descriptions within the Centennial HMA are expected to be substantial.

The second approach for assessing habitat potentials involves establishing and maintaining exclosures in conjunction with established monitoring study sites exposed to grazing. Under this approach duplicate field studies plots are established and monitored within the constructed exclosures. Over time, site conditions and species composition within the exclosures are compared and evaluated against those present outside the exclosure. Exclosures must be sized to encompass the area needed to accommodate the duplicated field studies. Based on the current monitoring studies in place on the NAWS-CL North Range, the minimum recommended exclosure size would involve fencing an area with the dimensions approaching 150 feet long by 75 feet wide, or about 0.25 acres. The exclosure must be sited in the same ecological site as the paired grazed site to allow for the direct comparison of habitat potentials between sites.

A limitation associated with this approach relates to the time and associated costs required to identify characteristics of the potential natural plant community through the incremental and often slow process of site recovery under conditions of grazing exclusion. In the arid conditions of NAWS-China Lake, recovery of upland sites can extend over several decades. The rate of site recovery can be greatly accelerated in riparian areas having perennial water sources due to the benefiting influence of free-soil moisture to plant establishment and growth.

The concepts and field methods employed under these two alternative approaches for assessing habitat potentials are specified in the National Range and Pasture Handbook (NRCS 1997) and BLM (1999).

3.5 MANAGEMENT RECOMMENDATIONS SUMMARY

3.5.1 Wild Horse Management

- Based on modeling of four Management Strategies, this WHBMP provides two sustainable approaches to achieving the AML. Management Strategies 3 and 4 incorporate a mix of management actions. Management Strategy 4 requires an initial impetus investment in order to control long-term herd maintenance costs. This strategy provides for first getting the population down to, and stabilized, within the 100 to 168 range. With the aid of fertility control, the excess would then be removed exclusively from the two-year-olds and younger animals, and the breeding herd would be left on the rangeland for the duration of their lives. The young animals are the most desirable for adoption, and the high cost of

sending animals to long-term holding is avoided after the initial gather cycle. Management Strategy 4 uses similar management techniques but eliminates the use of long term holding, bringing the herd within AML over 20 years. Both Management Strategies are recommended over current or traditional management methods and both will require an increase in dedicated funds. Both will require a commitment to fertility control.

Wild horse populations can be controlled, but annual recruitment must be reduced to a level equivalent to annual death loss plus what will be removed. Fertility control is the only means available to significantly reduce annual recruitment. The recruitment must be reduced significantly in order to get the removal numbers low enough so the animals can all be adopted and the cost of long term holding avoided.

The best management solution for the Centennial Herd will involve full gathers and selective removal in addition to fertility control. This will require a substantial expense every three to four years. Current management cannot control the growth rate of the herd and will result in the Centennial Herd tripling in ten years (Management Strategy 1). The herd has increased from 254 in 2008 to 532 in 2011 (Table 3.2.2-1 plus the 2011 foal crop).

If horse populations triple, the Navy will be confronted with a cost of $5 million or more to reduce populations down to a manageable level. This situation assumes that well over 1,000 unadoptable horses could be placed in a long term holding facility. In reality, it is at best uncertain if BLM would be able to take the 224 unadoptable horses to be removed under Management Strategy 3, given the dilemma BLM has over its own long-term holding costs and public resistance to BLM approaches to wild horse and burro management. Unless immediate action is taken to address the increases to the Centennial wild horse population, the Navy could soon see the population to explode. This would result in overgrazing, increased rate of habitat degradation, natural and cultural resources damage, and possibly unnecessary wild horse die-off during drought periods or severe winters.

Management of the Centennial Herd is a fiscally challenging situation. Wild horse management has understandably not been given budget priority in competition with other natural resource programs, particularly with regards to endangered species management efforts. Funding has been provided during most budget cycles; however, levels have been too low to create stable herd numbers and a fiscally sustainable wild horse program. Fertility control must be used to restrain annual herd recruitment in order to get the herd down to AML (100 to 168). A license must be applied for and a commitment made to apply initial and follow-up birth control treatments on a systematic schedule. It is recommended that the Centennial Herd management budget become sufficient and reliable to make this possible. There is no realistic method to avoid a horse population explosion, accelerated rate of environmental degradation and significantly increased costs to address the issue at a later date.

- Given this backdrop, the recommended management is Management Strategy 3, Management Strategy 4, or a blend of the two. Blending would provide the option to remove lower numbers of unadoptable horses at the outset coupled with commensurate extensions of time to get to AML. Additionally, Management Strategy 1 should continue to be used to do selective roping when funding is limited. Although not ideal Strategy 1 will reduce the rate at which the herd size increases. Use of the post-gather census technique is recommended for the Centennial Herd (Section 3.2.2.2 Census). It is further suggested that NAWS-CL examine new statistically-based techniques, along with the cost of training

and application, to determine if the technology is deemed worthwhile for application to the smaller post-gather numbers.

- BLM research administrators have indicated that the Centennial Herd could easily be included in the BLM's current EPA authorized PZP fertility control program. Requirements include completing and submitting a management plan including PZP fertility control and approval from the national Wild Horse and Burro Program office. This step is recommended. Procedures are just now evolving for the new fertility control practice. NAWS-CL should monitor changes in BLM procedures for data collection as BLM gains further experience.

- Consider an oral contraceptive for future use in the Centennial Herd if one is developed. An oral contraceptive could potentially reduce management costs by reducing the frequency of gathers while slowing the growth rate of the herd.

- NAWS-CL should take advantage of opportunities to generate name recognition for the China Lake Centennial Herd to help market excess animals for adoption. A promotional campaign is recommended for the Centennial Herd.

- Genetic variability is affected by almost all herd management decisions and its loss could reduce the overall health and fitness of the herd over the long term. It is recommended that genetic baseline sampling be conducted every ten to 15 years and more frequently if there is a recognized concern regarding low genetic diversity. DNA testing can now be done through Texas A&M University using hair samples. Using a minimum sample size of 25 animals, testing can be conducted for under $1,100.

3.5.2 Habitat Management

- To reduce catastrophic wildfire risk, NAWS-CL should conduct a wildfire risk/hazard assessment and develop a fire ignition risk and fuels management plan. That would identify areas of highest risk and treatment alternatives. In addition, protection strategies would be developed for important cultural resources such as historic mine sites, homesteads, and remote facilities. While indirectly related to wild horse and burro management, the increasing threat of large wildfires poses a threat to resources, wildlife, and wild horse populations.

- The existing monitoring program on the North Range should continue to maintain the value and investment in the compiled historic data sets. The field study methods employed to date represent sound and scientifically-accepted approaches for monitoring general vegetation trends over time. This monitoring program should be expanded in the future as new resource issues, conditions, or priorities are identified. For the purpose of building confidence in the habitat monitoring results, it is strongly recommended that a formal monitoring plan be budgeted and developed to institutionalize the details associated with the current program. The process of developing this plan has begun in the Range Assessment Survey Report (TDI 2011). It is recommended the Key Species Method, as specified in BLM (1996), be continued in conjunction with the ongoing habitat studies located at the 20 established monitoring sites due to the uncertain nature on how horse grazing influences vegetation over time.

- Swanson et al. (2006) recommended a minimum quadrat size of 30 by 30 inches for Southern Great Basin and Mojave Desert environments. Many of the plant species frequencies recorded by Epsilon (2006) fell well below the minimum 10 or 20 percent threshold recommended by BLM (1999) and Swanson et al. (2006) for producing suitable data sets sensitive to detecting change between sampling

intervals. If a larger quadrat is transitioned into the ongoing monitoring program, it is recommended that a Nested Frequency Method be employed where a quadrat frame having the nested plot sizes of 30 by 30, 20 by 20, and 10 by 10 inches is utilized. This recommendation was followed in the current (2011) Range Assessment Survey Report.

- Use pattern mapping, as defined in BLM (1996), may also be warranted in the future to help define where concentrated horse use occurs under current herd management practices and is having an appreciable effect on the vegetation resource. This information could become very valuable in defining areas where additional trend studies should be located in the future.

- The monitoring of plant species frequency and substrate ground cover categories over time provides an indication of the trends for these site attributes, but provides very little information on how closely the existing plant community approximates the identified natural plant community adapted to a particular site. Movement of the existing NAWS-CL habitat monitoring program toward the monitoring of ecological status or departures from the potential natural plant community is viewed here as a supplemental monitoring component rather than replacement of the existing habitat monitoring program.

- The habitat monitoring program now in place does not currently provide resource information on how horse use (or other factors) is affecting the vegetation resource and functionality in riparian areas associated with springs or the limited perennial streams that occur within the North Range. The use of exclosures or development of ecological site descriptions, can be used to ascertain habitat potentials in riparian areas. Additional recommendations may be found in the body of this report.

3.5.3 Inter-Agency Cooperative Management

- Cooperative management with agency partners should be improved in the context of the whole ecosystem in which the Centennial Wild Horse Herd and the burros live. The agency partnership between NAWS-CL and the BLM should be enhanced through the existing MOU for cooperation on horses. There is an opportunity to increase cooperative management efforts with regards to implementation of a long-term contraceptive program.

- For burros, considerable time and expense is devoted to capturing and removing burros that propagate from higher burro populations on lands of neighboring Federal agencies; Death Valley National Park, NTC Fort Irwin, and BLM. Agencies may be losing ground in their efforts to achieve zero AML for burros. These agencies are encouraged to develop a comprehensive joint census and removal plan to achieve their objectives, decrease funding requirements, and achieve AML for burros. The plan should detail the ways, means, and schedule that will be used to cooperatively accomplish the AML.

- Should the BLM not be capable of accepting animals into their program the Navy may consider placement with other organizations or individuals capable of properly caring for excess animals.

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Appendix A

Jenkins Model

MANAGEMENT OPTION 1

Gate-cut gathers of roughly eight percent of the herd every year. This management option reflects no change from current management practices.

PARAMETERS

Age Class	Females	Males
foal	11	5
1	12	7
2	14	12
3	7	8
4	4	3
5	5	3
6	6	3
7	5	7
8	7	6
9	5	12
10-14	33	54
15-19	24	32
20+	7	8

Derived from the 1995 China lake age-sex distribution. Adjusted for a herd of 300 animals.

FOALING RATE

Age Class	Foaling Rate
foal	0
1	0
2	0.085
3	0.500
4	0.524
5	0.714
6	0.739
7	0.739
8	0.593
9	0.739
10-14	0.742
15-19	0.400
20+	0.200

These are foaling rates for 1996-2000 for feral horses at Pryor Mountain, Montana, as reported by Linda Coates-Markle of the BLM. There were no data for 20+ year-old horses, so a foaling rate equal to half that for 15-19 year-olds was arbitrarily used. These figures were used due to the lack of age distributed foaling data for the China Lake herd. The foaling rate for all age classes combined for the China Lake herd has been calculated to be 53 percent assuming a growth rate of 16 percent and a sex ratio of 53:47 favoring males as indicated by the 1995 gather.

Survival rate = .95 percent (91.7 for under one year, 96.9 for one to two year, Granite Range data)
Sex Ratio = 50:50 (males)

RESULTS

Average Growth Rate in 10 years	
Lowest Trial	5.7
10th Percentile	8.6
25th Percentile	9.9
Median Trial	11.9
75th Percentile	13.8
90th Percentile	14.9
Highest Trial	17.9

	Population Sizes in 11 Years [1/]		
	Minimum	**Average**	**Maximum**
Lowest Trial	227	284	319
10th Percentile	268	315	358
25th Percentile	299	348	398
Median Trial	322	386	476
75th Percentile	344	443	554
90th Percentile	374	492	643
Highest Trial	439	583	886

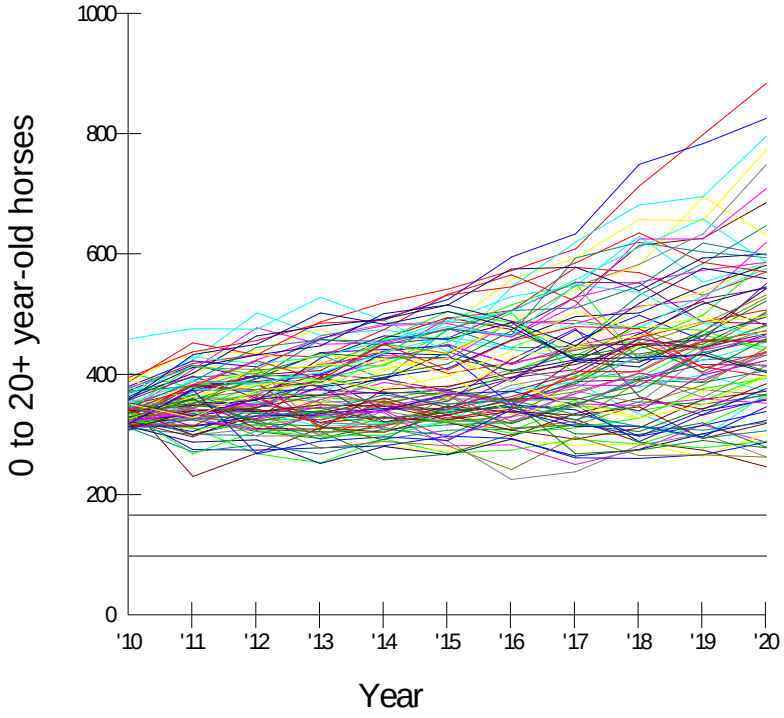
[1/] 0 to 20+ year-old horses

	Totals in 11 Years [1/]	
	Gathered	**Removed**
Lowest Trial	207	190
10th Percentile	239	220
25th Percentile	266	240
Median Trial	299	276
75th Percentile	342	314
90th Percentile	388	354
Highest Trial	457	429

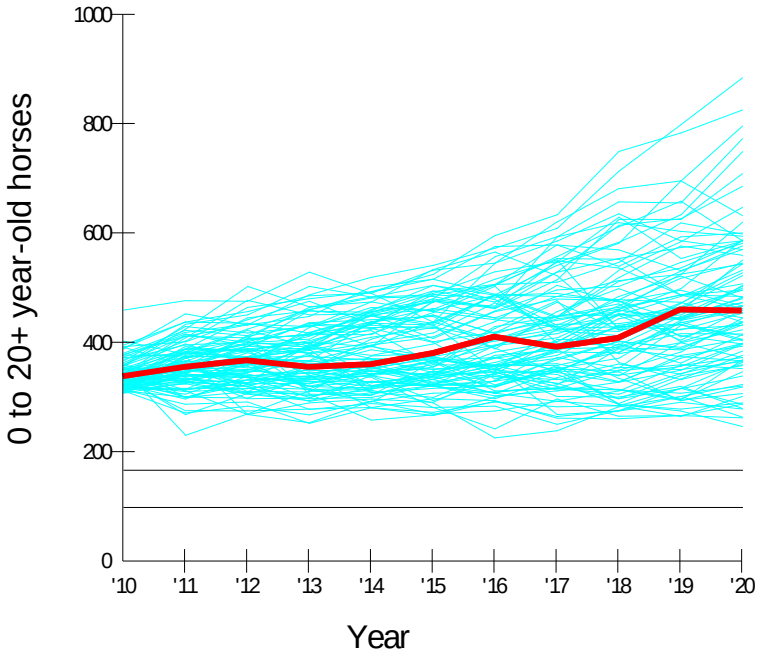
[1/] 0 to 20+ year-old horses

Removal Distribution	
0-1 year-olds	96
2-year-olds	32
3-year-olds	30
4-year-oldss & over	116

Projected Population Growth



Most Typical Trial



MANAGEMENT **STRATEGY 2**

Gate cut removals every two years of when herd exceeds 150 animals. Animals are removed to reach AML and unadoptable animals are sent to long term holding.

PARAMETERS

Age Class	Females	Males
foal	18	8
1	22	13
2	23	20
3	13	14
4	8	6
5	9	5
6	10	6
7	10	12
8	12	12
9	15	28
10-14	52	85
15-19	42	57
20+	15	17

Derived from the 1995 China lake age-sex distribution. Adjusted for a herd of 532 animals.

FOALING RATE

Age Class	Foaling Rate
foal	0
1	0
2	0.085
3	0.500
4	0.524
5	0.714
6	0.739
7	0.739
8	0.593
9	0.739
10-14	0.742
15-19	0.400
20+	0.200

These are foaling rates for 1996-2000 for feral horses at Pryor Mountain, Montana, as reported by Linda Coates-Markle of the BLM. There were no data for 20+ year-old horses, so a foaling rate equal to half that for 15-19 year-olds was arbitrarily used. These figures were used due to the lack of age distributed foaling data for the China Lake herd. The foaling rate for all age classes combined for the China Lake herd has been calculated to be 53 percent assuming a growth rate of 16 percent and a sex ratio of 53:47 favoring males as indicated by the 1995 gather.

Survival rate = .95 percent (91.7 for under one year, 96.9 for one to two year, Granite Range data)
Sex Ratio = 50:50

RESULTS

Average Growth Rate in 10 years	
Lowest Trial	0.3
10th Percentile	6.8
25th Percentile	9.5
Median Trial	12.6
75th Percentile	14.1
90th Percentile	15.8
Highest Trial	20.2

	Population Sizes in 11 Years [1/]		
	Minimum	**Average**	**Maximum**
Lowest Trial	63	159	536
10th Percentile	92	168	542
25th Percentile	98	173	558
Median Trial	106	179	575
75th Percentile	113	183	613
90th Percentile	116	188	648
Highest Trial	123	208	788

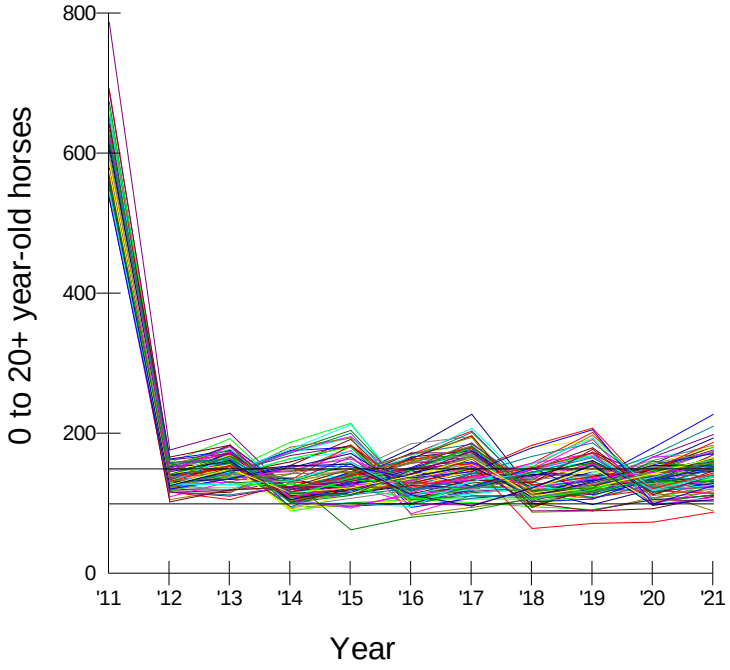
[1/] 0 to 20+ year-old horses

	Totals in 11 Years [1/]	
	Gathered	**Removed**
Lowest Trial	394	322
10th Percentile	420	350
25th Percentile	470	398
Median Trial	502	426
75th Percentile	540	465
90th Percentile	584	495
Highest Trial	709	601

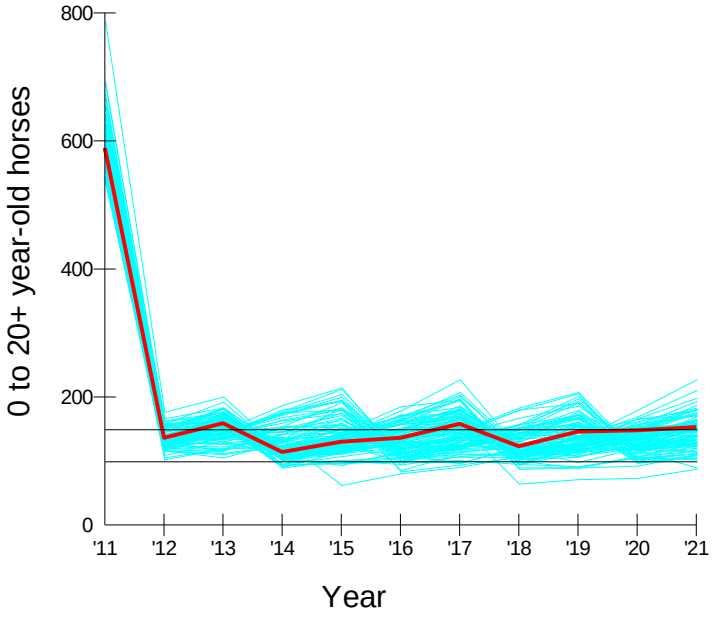
[1/] 0 to 20+ year-old horses

Removal Distribution	
0-2 year-olds	159
3-year-olds & over	287

Projected Population Growth



Most Typical Trial



MANAGEMENT STRATEGY 3

80 percent gathers on a four-year cycle with fertility control. The first gather is a gate cut removal to reach AML followed by selective removals of only animals two and under.

PARAMETERS

Age Class	Females	Males
foal	18	8
1	22	13
2	23	20
3	13	14
4	8	6
5	9	5
6	10	6
7	10	12
8	12	12
9	15	28
10-14	52	85
15-19	42	57
20+	15	17

Derived from the 1995 China lake age-sex distribution. Adjusted for a herd of 532 animals.

FOALING RATE

Age Class	Foaling Rate
foal	0
1	0
2	0.085
3	0.500
4	0.524
5	0.714
6	0.739
7	0.739
8	0.593
9	0.739
10-14	0.742
15-19	0.400
20+	0.200

These are foaling rates for 1996-2000 for feral horses at Pryor Mountain, Montana, as reported by Linda Coates-Markle of the BLM. There were no data for 20+ year-old horses, so a foaling rate equal to half that for 15-19 year-olds was arbitrarily used. These figures were used due to the lack of age distributed foaling data for the China Lake herd. The foaling rate for all age classes combined for the China Lake herd has been calculated to be 53 percent assuming a growth rate of 16 percent and a sex ratio of 53:47 favoring males as indicated by the 1995 gather.

Survival rate = .95 percent (91.7 for under one year, 96.9 for one to two year, Granite Range data)
Sex Ratio = 53:47 (males)
Fertility Control = 94 percent (Year 1), 82 percent (Year 2), and 68 percent (Year 3)

RESULTS

Average Growth Rate in 12 Years	
Lowest Trial	-0.3
10th Percentile	3.1
25th Percentile	5.0
Median Trial	7.7
75th Percentile	9.6
90th Percentile	11.7
Highest Trial	14.1

	Population Sizes in 12 Years [1/]		
	Minimum	**Average**	**Maximum**
Lowest Trial	68	84	103
10th Percentile	76	101	130
25th Percentile	82	112	152
Median Trial	86	122	164
75th Percentile	91	132	186
90th Percentile	98	139	205
Highest Trial	111	165	242

[1/] 0 to 20+ year-old horses

	Totals from First Gather [1/]		
	Gathered	**Removed**	**Treated**
Lowest Trial	329	268	0
10th Percentile	340	276	0
25th Percentile	346	281	0
Median Trial	359	293	0
75th Percentile	378	306	0
90th Percentile	400	325	0
Highest Trial	442	360	0

[1/] 0 to 20+ year-old horses

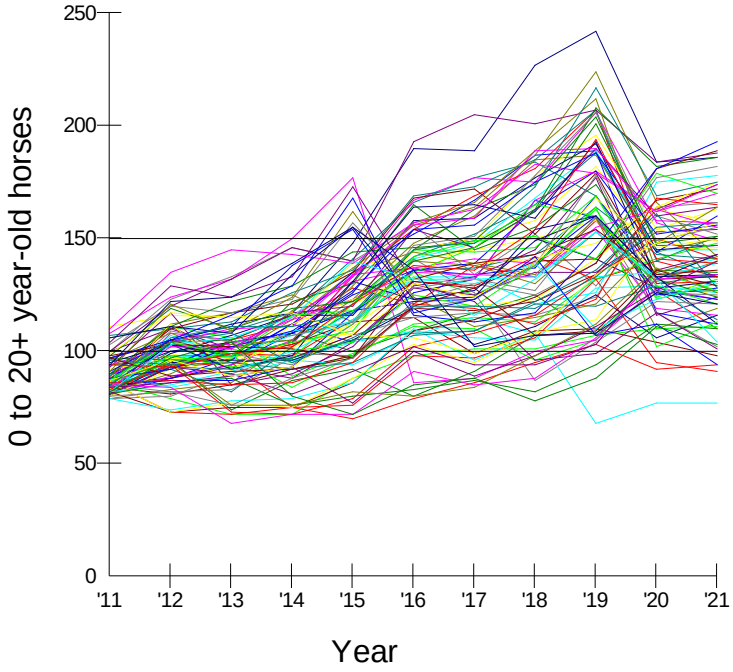
	Totals after 12 years [1/]		
	Gathered	**Removed**	**Treated**
Lowest Trial	175	0	51
10th Percentile	212	0	71
25th Percentile	234	0	75
Median Trial	271	54	79
75th Percentile	296	69	86
90th Percentile	313	78	93
Highest Trial	351	117	107

[1/] 0 to 20+ year-old horses

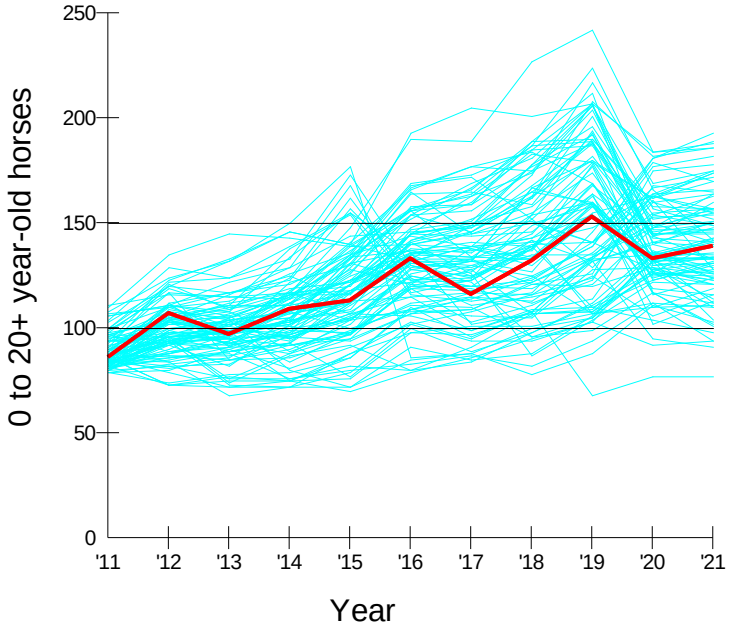
Removal Distribution	
0-2 year-olds	371
3-year-olds & over	0

Projected Population Growth

(After initial gather to reach AML)



Most Typical Trial



MANAGEMENT STRATEGY 4

80 percent gathers on a three-year cycle with fertility control. Only animals 2 and under are removed for adoption. This management option is projected to reach AML within 25 years.

PARAMETERS

Age Class	Females	Males
foal	18	8
1	22	13
2	23	20
3	13	14
4	8	6
5	9	5
6	10	6
7	10	12
8	12	12
9	15	28
10-14	52	85
15-19	42	57
20+	15	17

Derived from the 1995 China lake age-sex distribution. Adjusted for a herd of 352 animals.

FOALING RATE

Age Class	Foaling Rate
foal	0
1	0
2	0.085
3	0.500
4	0.524
5	0.714
6	0.739
7	0.739
8	0.593
9	0.739
10-14	0.742
15-19	0.400
20+	0.200

These are foaling rates for 1996-2000 for feral horses at Pryor Mountain, Montana, as reported by Linda Coates-Markle of the BLM. There were no data for 20+ year-old horses, so a foaling rate equal to half that for 15-19 year-olds was arbitrarily used. These figures were used due to the lack of age distributed foaling data for the China Lake herd. The foaling rate for all age classes combined for the China Lake herd has been calculated to be 53 percent assuming a growth rate of 16 percent and a sex ratio of 53:47 favoring males as indicated by the 1995 gather.

Survival rate = .95 percent (91.7 for under one year, 96.9 for one to two year, Granite Range data)
Sex Ratio = 53:47 (males)
Fertility Control = 94 percent (Year 1), 82 percent (Year 2), and 68 percent (Year 3)

RESULTS

Average Growth Rate in 11 years	
Lowest Trial	-2.9
10th Percentile	-0,4
25th Percentile	1.2
Median Trial	3.0
75th Percentile	5.3
90th Percentile	6.1
Highest Trial	8.8

	Population Sizes in 11 Years [1/]		
	Minimum	**Average**	**Maximum**
Lowest Trial	195	291	540
10th Percentile	263	398	558
25th Percentile	297	428	574
Median Trial	359	482	604
75th Percentile	430	537	646
90th Percentile	482	594	728
Highest Trial	547	654	854

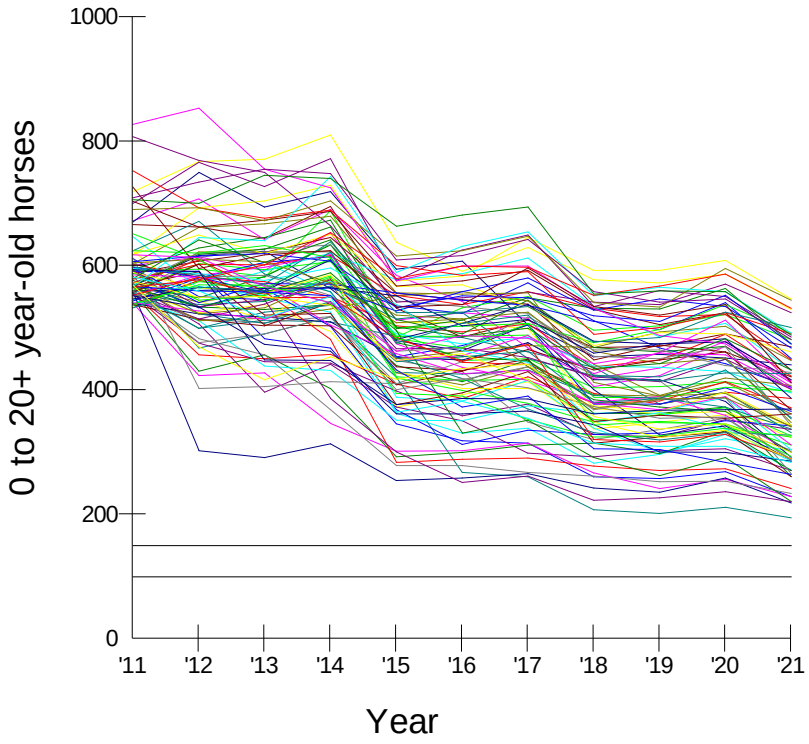
[1/] 0 to 20+ year-old horses

	Totals in 11 Years [1/]		
	Gathered	**Removed**	**Treated**
Lowest Trial	921	219	208
10th Percentile	1093	278	253
25th Percentile	1204	320	289
Median Trial	1328	371	318
75th Percentile	1464	431	358
90th Percentile	1651	482	396
Highest Trial	1799	575	442

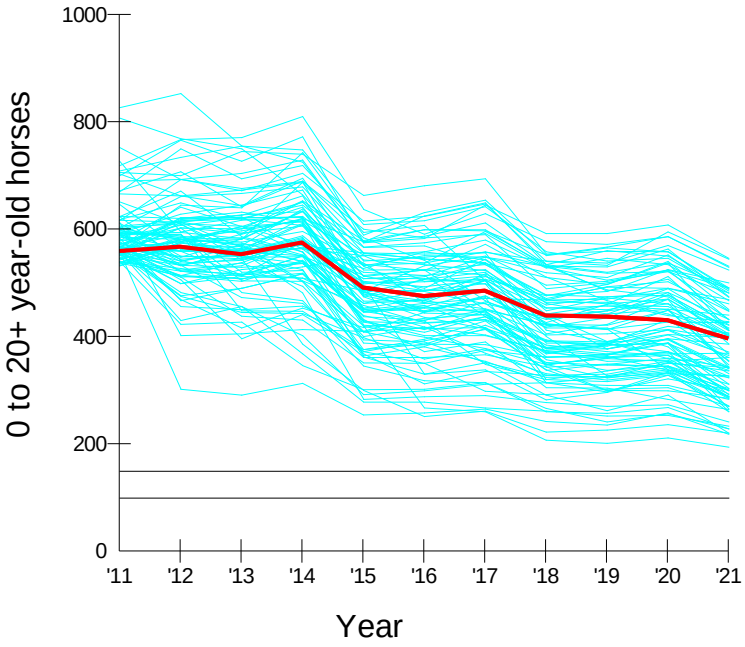
[1/] 0 to 20+ year-old horses

Removal Distribution	
0-2 year-olds	371
3-year-olds & over	0

Projected Population Growth



Most Typical Trial



Appendix B

Cost Details

Cost Analysis

The costs used for comparison of the Management Strategies presented in this report were obtained from the BLM for fiscal year 2008. Current costs will likely be considerably higher. The cost of vaccination with porcine zona pellucida (PZP) was taken from the 2009 BLM instructional memo on population-level fertility control trials (IM# 2009-090). This figure was listed as approximately $250 per animal treated.

All other costs were obtained from the Ridgecrest BLM in a document titled "Cost of Helicopter Assisted Removal and Placement of Wild Horses and Burros from China Lake Naval Air Weapons Station (NAWS) FY 2008 (Included in this appendix). The cost of sending an animal to long-term holding in a sanctuary situation was verified in conversation with Mr. Art DiGrazia, BLM Ridgecrest Wild Horse and Burro Operations Manager.

The costs used for our calculations are as follows:

Cost of Gather and Removal: $500 per animal

Cost of Preparation and Adoption: $1,700 per animal

Cost of Long Term Holding = $6,000 per animal

The number of animals successfully adopted from each age group is a very important figure in assessing the cost of each management option. Animals not successfully adopted by the age of five are considered "unadoptable" for our purposes and are sent to a "Sanctuary" or long term holding facility. Adoption percentages by age class were obtained from Dean Balstead's staff at the National Wild Horse and Burro Program office in Reno, NV.

Adoption success percentages by age class are as follows:

1-year-olds and under = 90%

2-year-olds = 50%

3- to 5-year-olds = 33%

6-year-olds and over = 8%

The following table (Centennial Herd Management Strategies – Costs) presents a detailed assessment of cost for each Strategy presented in the NAWS/China Lake Wild Horse and Burro Management Plan 2009 Update. Final cost figures may differ slightly from those shown in the body of the Plan due to rounding.

1. selective removal (road hunt) to spend $95,000. Remove 2 and under

2. gate cut gather every 2 years. Reduce to AML via long term holding

3. selective removal and fertility control on 4 year cycle. Initial gather reduces herd to AML via long term holding then move to sective removal.

4. selective removal and fertility control 3 year cylce.

alternative #	animals gathered	gather cost $500	age	animals removed	adoption cost $1700	cost of sanctuary $6000	animals treated	cost of treatment $250	total cost	annual cost	average herd size in 11 years
1	473	$236,500.00	0-2	473	$804,100.00				$1,040,600.00	$94,600.00	1616
2	502	$251,000.00	0-2	159	$270,300.00		0		$2,243,300.00	$203,936.36	179
			3+	287		$1,722,000.00					
3	630	$315,000.00	0-2	123	$209,100.00		79	$19,750.00	$1,887,850.00	$145,219.23	122
	(359 in first year)		3+	224		$1,344,000.00					
First gather will cost ~ $1,500,000											
4	1328	$664,000.00	0-2	371	$630,700.00		318	$79,500.00	$1,374,200.00	$124,927.27	482
			3+	0							

Pop will drop to AML within 25 years.

We assumed that any horse 3 years old or olders would not be accepted into the BLM adoption program and would be sent to long term holding.

COST OF HELICOPTER ASSISTED REMOVAL AND PLACEMENT OF WILD HORSES AND BURROS FROM CHINA LAKE NAVAL AIR WEAPONS STATION (NAWS) FY 2008

FUNDING AVAILABLE

NAWS Funding -21% Admin. Fees = $81,000 – $ 17,010	= $63,990
Power and Water supply at Corrals (credit)	= $ 9,000
TOTAL NAWS FUNDING	$72,990

CONTRACTING COSTS

SLATE RANGE (Average Capture Cost = $584/Burro)

Burro Drive Trapping	@ $485.00 per animal	(based on 25-50 head removal)
Burro Roping Cost per Head	@ $683.00 per animal	(+ $198 roping costs)
Transportation Costs 100mi	@ $3.31 per mile = $331.00	

CENTENNIAL (Average Capture Cost = $640/Horse)

Horse / Burro Drive Trapping	@ $541.00 per animal	(based on 11-24 head removal)
Horse/ Burro Roping Cost per Head	@ $739.00 per animal	(+$198 roping costs)
Transportation Costs 200mi	@ $3.31 per mile = $662.00	

DAILY RATE COST FOR A COMPLETE GATHER: $9,922.00
DAILY RATE COST WITHIN AN EXISTING GATHER OPERATION: $8,269.00

Project Inspector Costs = $2,000.00
Transportation Costs = $ 993.00

Available Funding = $72,990 - $993 (trans. cost) - $2000 (PI) = $69,997

HORSE PREPARATION AVERAGE COST = $776.00
Preparation Cost = $853.50 / Male
Preparation Cost = $698.50 / Female

$ 4.00 Health Certificate
$ 14.00 Branding and Animal File (Branding-$10.00; neck tag & rope - $2.00; file – $2.00)
$155.00 Castration of studs ($115.00 Vet Cost + $40.00 BLM Labor)

$ 96.00 Administered Equine Vaccines
- $11.00 Tetanus/E&W Encephalomyelitis
- $17.00 Rhinopneumonitis/Influenza
- $17.00 Strangles
- $21.00 West Nile Virus
- $13.00 Rabies
- $17.00 Dewormed

$ 22.00 for Coggins Blood test

$375.00 Feed for 150 day preparation period ($200 per ton and 25 pounds per animal per day)
$ 37.50 Feeding for 150 day period ($0.25 per animal per day)
$150.00 Holding and Care for 150 day Preparation Period @ $1.00 / day / animal
$853.50 Total Preparation Costs for Male Horse

BURRO PREPARATION COSTS = $428.00

$ 4.00 Health Certificate
$ 14.00 Branding and Animal File (Branding-$10.00; neck tag & rope - $2.00; file – $2.00)

$ 96.00 Administered Equine Vaccines
- $11.00 Tetanus/E&W Encephalomyelitis
- $17.00 Rhinopneumonitis/Influenza
- $17.00 Strangles
- $21.00 West Nile Virus
- $13.00 Rabies
- $17.00 Dewormed

$ 22.00 for Coggins Blood test

$180.00 Feed for 90 day preparation period ($200 per ton and 20 pounds per animal per day)
$ 22.50 Feeding for 90 day period ($0.25 per animal per day)
$ 90.00 Holding and Care for 90 day Preparation Period @ $1.00 / day / animal
$428.00 Total Preparation Costs Per Burro

ADOPTION AND COMPLIANCE COSTS = $410.00

$365.00 Adoption and Placement (California State Average cost for adoption per animal)
$ 45.00 Compliance and Titling per animal
$410.00 Total

AVERAGE COST PER HORSE PREPPED AND ADOPTED	**= $ 1,186.00**
AVERAGE COST PER HORSE GATHERED AND REMOVED	**= $ 640.00**
AVERAGE TOTAL COST PER HORSE	**= $ 1,826.00**

AVERAGE COST PER BURRO PREPPED AND ADOPTED	**= $ 838.00**
AVERAGE COST PER BURRO GATHERED AND REMOVED	**= $ 584.00**
AVERAGE TOTAL COST PER BURRO	**= $ 1,422.00**

Available Funding = $69,997

Estimated number of horses that can be removed = $69,997/$1,826 = 38 horses

OR

Estimated number of burros that can be removed = $69,997/$1,422 = 49 burros

OR

18 horses @ $ 1,826 / horse =	**$32,868**
26 burros @ $1,422 / burro =	**$36,972**
TOTAL	**$69,840**

Appendix C

Spring Development

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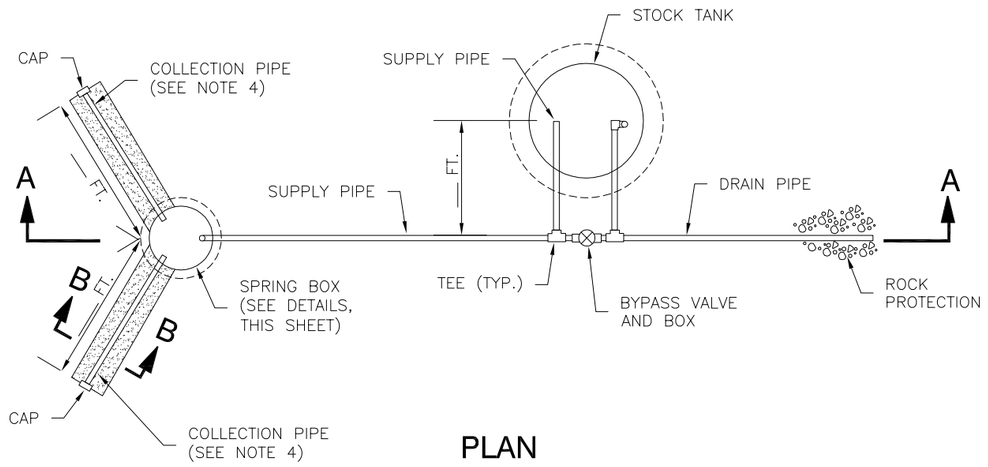

PLAN
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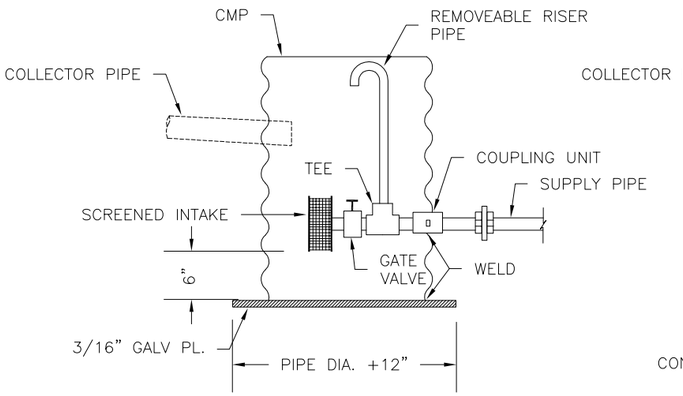

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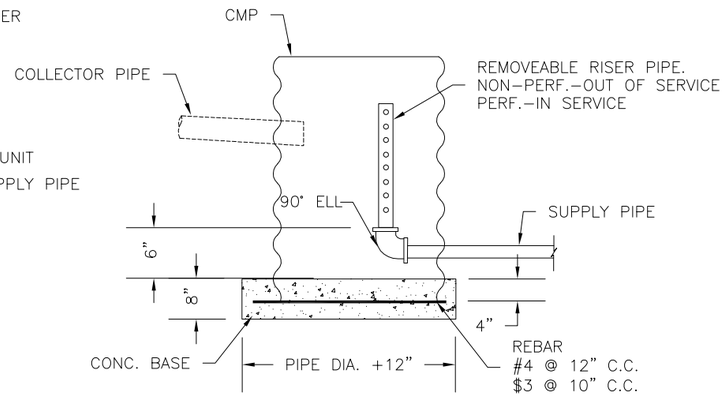

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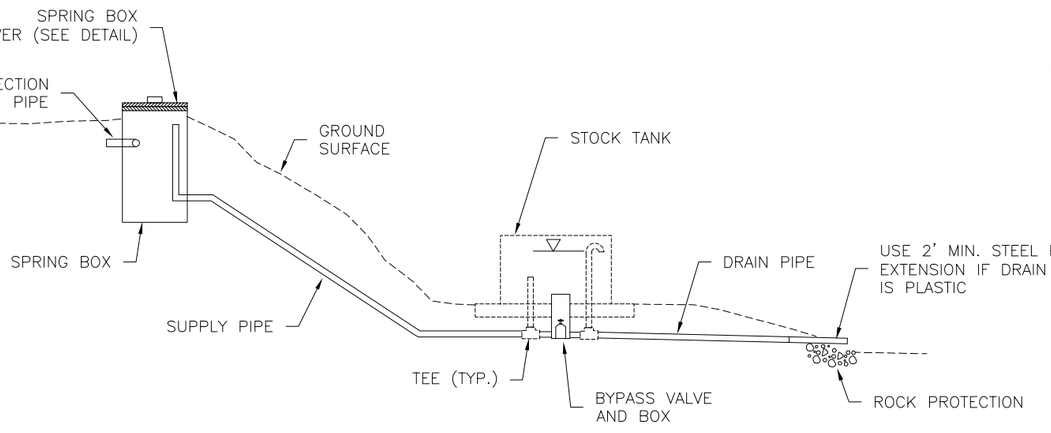

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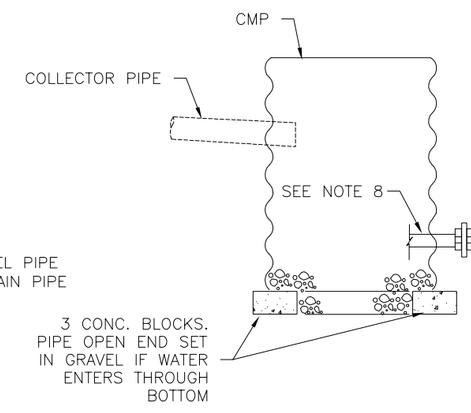

TYPE C SPRING BOX
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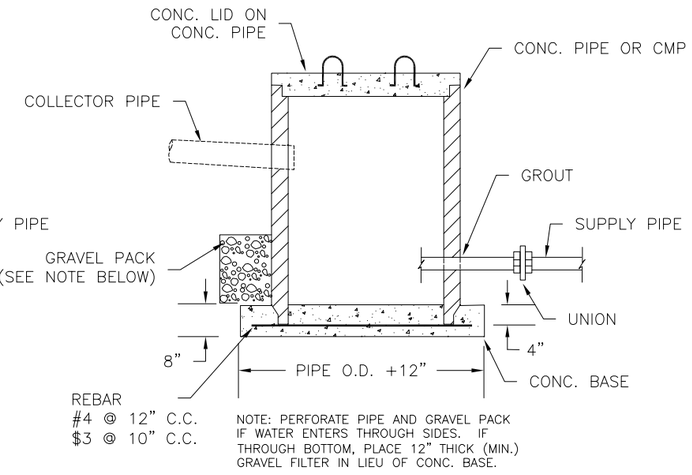

TYPE D SPRING BOX
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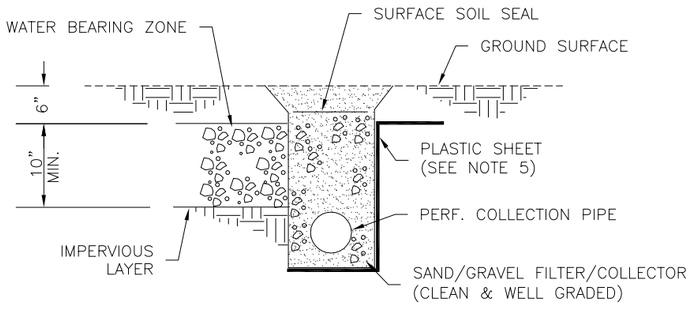

SECTION B - B
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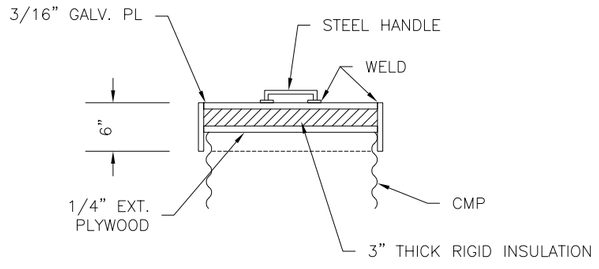

SPRING BOX COVER
NO SCALE

GENERAL NOTES:

1. IF WATER BEARING ZONE EXTENDS DOWN SLOPE OF SPRING BOX, EXTEND PLASTIC SHEET CUTOFF TRENCH AROUND DOWN SLOPE SIDE OF SPRING BOX.
2. DELETE ITEMS NOT APPLICABLE TO INSTALLATION AND SKETCH IN CHANGES IN RED.
3. FILL IN QUANTITY, LENGTH, SIZE, AND TYPE OF MATERIALS NEEDED ON SHEETS.
4. INSTALL COLLECTION SYSTEM CONFIGURATION TO BEST FIT SITE CONDITION OR NEEDS.
5. USE FLEXIBLE MEMBRANE 12 MIL. MIN. THICKNESS.
6. FENCE COLLECTION AREA TO PREVENT LIVESTOCK DAMAGE TO SOIL SURFACE SEAL.
7. ADD OVERFLOW OUTLET AS NEEDED AT AN ELEVATION BELOW RISER PIPE.
8. USE TYPE A OR B INLET PLUMBING.
9. USE ANY COMBINATION OF MATERIALS, BASES AND INLETS SHOWN IN OPTION A THROUGH D TO MEET NEEDS AND SITE CONDITIONS.

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SPRING DEVELOPMENT DETAILS

09-607.6/10-27-09

RESOURCE CONCEPTS, INC.

Appendix D

Annotated Bibliography

Abella, Scott R. 2008. A Systematic Review of Wild Burro Grazing effects on Mojave Desert Vegetation, USA. Environmental Management. Published online April 1, 2008.
A review of 24 documents relating to diet analysis and impacts of burro grazing. Studies suggest that burros preferentially eat graminoid and forb groups over shrubs and consume a wide variety of plant species. Some studies indicated diets dominated by exotic annuals. All studies indicate that burros can forage on a variety of plant species but will forage selectively when conditions allow.

APHIS, 2009. Wildlife Damage Management: Development of Reproductive Control Methods for Overabundant Birds and Mammals. U.S. Department of Agriculture. October, 2009. http://www.aphis.usda.gov/wildlife_damage/nwrc/research/reproductive_control/i ndex.shtml
Web site detailing the USDA's current research on fertility control including GonaCon and PZP, which are particularly pertinent to feral horses.

Armentrout, Donald, Rodger Bryan, and Richard Wheeler. 1988. Habitat Suitability Rating for Wild Horses and Burros in Nevada. Transactions of the Western Section of the Wildlife Society. 24:148-151.
Brief description of a habitat rating system established by the BLM in 1986. Numerical ratings are given to food, water, Cover, and Space resources.

Bartholow, J.M., 2004, An economic analysis of alternative fertility control and associated management techniques for three BLM wild horse herds: U.S. Geological Survey, Biological Resources Discipline, Open File Report 2004-119, 33pp.
An excellent analysis of costs relative to different herd management techniques. Indicates that the combination of a two-year PZP vaccine combined with selective management favoring a strong male sex ratio may be the most effective method of reducing costs. Favors the removal of young animals (under four years). Indicates that costs can be reduced by up to 30 percent using these methods.

Bastian, et al. 1999. Opportunity costs related to feral horses: a Wyoming case study. Journal of Range Management 52(2): 104-112.
Provides a case study of economic costs due to loss of grazing and wildlife use at increasing level of wild horse populations. Indicates that costs remain fairly stable until herd levels reach an unsustainable point at which resources, as well as grazing and wildlife opportunities, suffer.

Beever, Erick A., and Peter F. Brussard. 2000. Examining Ecological Consequences of Feral Horse Grazing Using Exclosures. Western North American Naturalist. 60(3):236-254. *A study of grazing impacts in areas only used by horses in the Great Basin. Exclosures and Study Sites were located near springs or wet areas. Vegetation height, species richness, and cover were dramatically higher in ungrazed areas.*

BLM. 1985. Rangeland monitoring – trend studies. USDI, Bureau of Land Management, Denver, CO. Tech. Ref. 4400-4.
This technical reference specifies agency approved methods and procedures to establish and maintain vegetation trend studies. This agency reference preceded and was superseded by BLM (1999) identified as Tech. Ref. 1734-4.

BLM. 1993. Riparian area management - Process for assessing properly functioning condition. Denver, CO. Tech. Ref. 1737-9.
This agency technical reference provides the background, science, methods and procedures for assessing the functionality of riparian-wetland areas. The assessment methods described in this technical reference are still widely employed today by federal land management agencies.

BLM. 1995. Grazing evaluation 1986-1995 for the Lacey-Cactus-McCloud Allotment. U.S. Department of the Interior, Bureau of Land Management, Ridgecrest, CA. September 1, 1995.
This document reflects a formal BLM evaluation of the 421,172 acre Lacey-Cactus-McCloud grazing permits. Indicates that 21 quadrat frequency trends plots were established and 20 out of the 21 sites showed a downward trend during the evaluation period. Also indicates that basal area and forage utilization were measured at each site; however, the locations for these trend plots are not disclosed in the allotment evaluation. Also indicates that two 10X10 ft. stereo photo plots were established to measure foliar cover but not re-sampled to establish trends. The locations of these stereo photo points were not disclosed. Handbook instructions for monitoring methods were also included in this allotment evaluation.

BLM. 1996. Utilization studies and residual measurements. USDI, Bureau of Land Management. Technical Reference (TR) 1734-3. Denver, CO. Pub. No. BLM/RS/ST-96/004-1730.
Developed by an Interagency Technical Committee, this handbook identifies and describes agency-approved methods for collecting and analyzing field monitoring information relating to forage utilization and residual measurements in rangeland environments. As referenced in this interagency technical reference, these monitoring study methods are approved for application on public lands administered by the USDI Bureau of Land Management and the USDA Forest Service.

BLM. 1999. Sampling vegetation attributes. USDI, Bureau of Land Management. Technical Reference (TR) 1734-4. Denver, CO. Pub. No. BLM/RS/ST-96/0021730.
Developed by an Interagency Technical Committee, this handbook identifies and describes agency-approved methods for collecting, measuring and analyzing attributes associated with native perennial vegetation. As referenced in this interagency technical reference, these monitoring study methods are approved for application on public lands administered by the USDI Bureau of Land Management and the USDA Forest Service.

BLM. 1999. California Desert Conservation Area Resource Management Plan (CDCA Plan), 1999 Reprint with 147 Amendments. USDI BLM Ridgecrest, CA.
Contains specific data as to when the Navy ended burro herd management areas in China Lake.

BLM. 2002. Pokegama Wild Horse Herd Management Area Plan. U.S. Department of the Interior, Bureau of Land Management, Lakeview District, Klamath Falls Resource Area.
A brief HMAP for a very small herd (30-60 animals) where genetic health is maintained by introductions of new horses from comparable herds.

BLM. 2002. FEIS- Final California Desert Conservation Area Plan Amendments for the Northern and Eastern Mojave Planning Area. USDI BLM, California Desert District, Riverside, CA.
Removal of Slate Range burro habitat and reductions in AML for Centennial, Panamint, and Slate Range HA's.

BLM. 2002. Dry Lake Complex Wild Horse Gather Plan and Environmental Assessment. NV-040-07-02 U.S. Department of the Interior, Bureau of Land Management, Ely Field Office.
HMAP suggests a threshold of 25 mares be used to determine PZP use. If less than 25 mares are released to range, no application of PZP will be include in the management for that gather.

BLM. 2003. Augusta Mountains Herd Management Area Gather Plan and Environmental Assessment. NV-020-03-22. U.S. Department of the Interior, Bureau of Land Management, Winnemucca Field Office.
HMAP detailing use of AML as a range rather than a hard number. Use of selective removal techniques, PZP vaccination, and sex ratio alteration.

BLM. 2003. Approved Elko Resource Management Plan Wild Horse Amendment and Decision Record. U.S. Department of the Interior, Bureau of Land Management, Elko Field Office. October, 2003.
Examples of AML's and brief description of Population Management Plan elements.

BLM. 2003. Strategic Research Plan: Wild Horse and Burro Management. Bureau of Land Management Wild Horse and Burro Program, U.S. Department of Interior.
Contains some good information regarding relevant legislation and fertility management options.

BLM. 2004. McCullough Peaks Herd Management Area Gather Plan and Fertility Control Implementation Plan. Environmental Assessment #: WY-020-E04-039**.** U.S. Department of the Interior, Bureau of Land Management, Cody Field Office, Cody, WY.
An excellent and informative HMAP. Fertility control has been a part of the McCullough Peaks HMA for several years. 75 percent of mares aged 5-9 were treated with two-year PZP and 100 percent of all other ages. Recommends a large removal to achieve AML mid-point of 100 animals. Very similar to China Lake situation.

BLM. 2005. Instructional Memorandum: Gather Policy and Selective Removal Criteria. IM 2005-206, August 10, 2005. U.S. Department of the Interior, Bureau of Land Management, Washington, D.C.
Details of national BLM policy on selective removal.

BLM. 2007. New Pass/Ravenswood and Augusta Mountains HMA's Burned Area Wild Horse Removal Environmental Assessment. NV062-EA07-188. U.S. Department of the Interior, Bureau of Land Management, Battle Mountain District.
Good assessment of appropriate management actions following a fire. Discussion of impacts to horses and resources. Appendix contains standard operating procedures for gathering and PZP vaccine administration.

BLM. 2008. Nevada Wild Horse Range Herd Management Plan. EA NV052-2008-223. U.S. Department of the Interior, Bureau of Land Management, Las Vegas Field Office.
An excellent and detailed HMAP which sets out several clearly defined alternatives. Especially pertinent for the HMA's proximity to Nellis Air Force Base and comparable desert environment.

BLM. 2009. Wild Horse and Burro Removal, Adoption, Population, ALM Table. http://www.wildhorseandburro.blm.gov/statistics/
Current statistics on horse and burro populations and management.

BLM. 2009. Wild Horse and Burro Herd Areas Administered by BLM FY 07. Table HAHMA2007stats.xls. http://www.wildhorseandburro.blm.gov/statistics/
Current statistics on HMA extents and ownership.

BLM. 2009. Instructional Memorandum: Population-Level Fertility Control Field Trials: Herd Management Area (HMA) Selection, Vaccine Application, Monitoring and Reporting Requirements. IM 2009-090, March 12, 2009. U.S. Department of the Interior, Bureau of Land Management, Washington, D.C.
Details of the BLM national policy on fertility control. A very thorough memo including recommendations on animal selection, identification and monitoring, and cost benefits.

BLM. 2009. Instructional Memorandum: Wild Horse and Burro Genetic Baseline Sampling. IM 2009-062, January 15, 2009. U.S. Department of the Interior, Bureau of Land Management, Washington, D.C.
Details of the BLM national policy on Genetic Baseline Sampling. Includes instructions, forms, and contacts for collection and processing of hair samples for DNA analysis.

BLM. 2009. Pryor Mountain Wild Horse Range/Territory Environmental Assessment and Herd Management Area Plan. MT-010-08-24. U.S. Department of the Interior, Bureau of Land Management, Billings Field Office.
Relying heavily on Rangeland Health Assessments (RHAs), this document provides a good example on how to tie resource objectives with RHAs and other available resource monitoring attributes.

BLM. 2009. GAO update: National Wild Horse & Burro Advisory Board Meeting, Sacramento, CA. June 15, 2009. U.S. Department of the Interior, Bureau of Land Management, Washington D.C.
Current information on gathering and holding statistics and costs. Also includes new BLM policy for herd census procedures.

BLM. 2010. Public Land Statistics. Wild Free-Roaming Horse and Burro Populations as of February, 2008. U.S. Department of the Interior, Bureau of Land Management, Washington, D.C. http://www.blm.gov/public_land_statistics/index.htm 3/19/2010
Most current statistics on number of wild horses and burros on public land by state.

Bohnert, D.W. 2009. Personal communication. Livestock and Ruminant Nutrition Specialist, University of Idaho. September 15, 2009.
In a telephone conversation with John McLain, discussed using oral contraceptives in the form of nutritional blocks for equine contraception. Discussed difficulties in targeting equines without impacting other wildlife species.

California Cooperative Extension. 1994. How to monitor rangeland resources. University of California, Davis, CA. Div. of Agric. and Nat. Res. Intermtn. Workgroup Pub. 2.
Developed by a Committee of Cooperative Extension Specialists, this handbook identifies and describes recommended field methods for collecting, measuring and analyzing biological attributes and effects associated with livestock and/or ungulate grazing in California.

Chaney, E. W. Elmore and W.S. Platts. 1990 "Livestock Grazing On Western Riparian Areas.
Useful information on management of riparian areas. Thorough discussion of grazing impacts including exacerbated use of riparian areas in desert areas. Wildlife is drawn to water and easy grazing in more productive areas.

Coates-Markle, Linda. 2000. Summary Recommendations – BLM Wild Horse and Burro Population Viability Forum, April 21, 1999. Resource Notes, Session 4, No. 35. Aug 1, 2000. U.S.D.I. Bureau of Land Management.

An overview of the proceedings of the BLM Wild Horse and Burro Population Viability Forum summarized in the preceding twelve resource notes. This document gives excellent recommendations and comments on maintaining genetic viability in a wild horse herd. Includes figures on cost and frequency of genetic monitoring. Specific recommendations regarding removal of young animals and maintenance of a mature herd in order to maintain genetic viability.

Cothran, Gus E. 2001. Genetic Analysis of the Centennial, CA HMA. Department of Veterinary Science, University of Kentucky, Lexington, KY.
A comprehensive report on the genetic health of the Centennial herd. The report indicates that, although there are a high number of genetic variants, heterozygosity is low. This is a possible indication of recent loss of overall variability. Recommendations include careful monitoring. Also indicates that any healthy population could supply animals for a herd introduction to supplement variability.

Cooper, Rick and Bill Phillips. 1987. Improving Adoptability of Wild Horses through Management. BLM. Susanville District.
Discussion of gathering methods and adoptability variance between ages and classes of horses.

DiGrazia, Art. 2009. Personal Communication. Wild Horse and Burro Program Manager, Ridgecrest, BLM. August 5, 2009.
Mr. DiGrazia is the BLM Wild Horse and Burro Corral Manager, Ridgecrest, CA. Discussed gather and removal procedures and timing for NAWS and surrounding agencies, BLM agreements with NAWS, BLM CA policy and procedures, and received a tour of the corrals and facilities.

EPSILON, 2005. NAWS/China Lake Wild Horse and Burro Management Plan. Unpublished.
Wild horse and burro management plan commissioned by the Navy in 2005. Some relevant portions of this document were retained in their entirety for the 2009 update. Other areas containing pertinent information were cited in text.

EPSILON, 2006. 2005/2006 Range Assessment Surveys for the Lacey-Cactus-McCloud Allotment. Prepared for the China lake Naval Weapons Station, California. December, 2006.
Of the 20 BLM trend transects previously established on the China Lake NAWS, this document reports the results of re-sampling 12 previously established BLM study sites that could be relocated, and establishes 8 additional study sites, for a total of 20 trend plots. Sites numbered between 7 and 21 represent original BLM transects, while sites numbered between 30 and 37 were established as new trend plots in 2005. These same sites were also read in 2006 by Epsilon.

Fitton, Sam. 2009. Personal communication. Natural Resource Specialist, Ridgecrest Field Office, USDI Bureau of Land Management. October 9, 2009.
In a telephone conversation with Don Henderson and Rex Cleary from Resource Concepts, Inc., Mr. Fitton clarified the permit status for the Lacey-Cactus-McCloud (LC-M) Allotment and the status of Bureau of Land Management (BLM) vegetation trend monitoring located within this allotment. This grazing permit has been inactive since the early 2000's, although the previous permit holder(s) have been promised by the BLM the first right of refusal when this allotment is reactivated upon completion of the pending permit renewal process. A primary issue relating to this permit renewal includes the construction and maintenance responsibilities for fencing along the western and northern boundaries of the NAWS North Range to prevent livestock trespass into this installation. Mr. Fitton clarified the 9 quadrat frequency transects reported in the 1995 allotment evaluation were located in the L-C-M Allotment outside the boundaries of the North Range. Some, but not all, of these trend studies are located within the boundaries of the Centennial Herd Management Area (HMA). These BLM trend studies have not been read since the allotment permit has become inactive; however, the historic trend data should be on file at the Ridgecrest Field Office.

Irons, Tracy, Bill Phillips, and Rick Cooper. 1990. Modoc/Washoe Experimental Stewardship Program: A comparison of Management Methods for Wild Horses. BLM. Surprise Resource Area, Susanville District.
Comparison of Gate-Cut vs. Structured Herd Management. Gives statistics from the experimental program including 89 percent to 93 percent adoption rates for structured herds and 65 percent adoption rate for gathered horses from the gate cut herd

Jenkins, Steven. 2009. Personal Communication. September 3, 2009.
Discussed reliability of standard figures for foaling rate and death rate for use in the Jenkin's Population Model. Also discussed the feasibility of drastic population reductions without removing un-adoptable horses.

Killian, Gary, David Thain, Nancy K. Diehl, Jack Rhyan, and Lowel Miller. 2008. Four-year contraception rates of mares treated with single injection porcine zona pellucida and GnRH vaccines and intrauterine devices. Wildlife Research, 2008. 35. 531-539.
A study comparing GonaCon (GnRH), SpayVac (PZP), and human intrauterine devices for long-term reproductive control. Indicates that both GonaCona and SpayVac may be effective for long-term reproductive control but shows that SpayVac was a stronger contraceptive over time. Also, mares treated with GonaCon did not continue to cycle as did mares treated with SpayVac. This could be valuable from a herd-stress perspective.

Kirkpatrick, Jay F., I.M.K. Liu, J.W. Turner, R. Naugle and R. Keiper. 1992. Long-term effects of porcine zonae pellucidae Immunocontraception on ovarian function in feral horses. Journals of Reproduction and Fertility Ltd. (1992) 94, 437-444.
Indicates that three consecutive years of PZP treatment may have long-term effects on ovarian function. This may be due to the quality of the innoculum used in the treatments. PZP seems to have a cumulative effect on ovarian function.

Kirkpatrick, Jay F., and Allison Turner. 2003. Absence of Effects from Immunocontraception on Seasonal Birth Patterns and Foal Survival among Barrier Island Wild Horses. Journal of Applied Animal Welfare Science. 6(4), 301-308.
Study of out-of-season births for wild horses on the Barrier Islands. Indicates that out-of-season birth rates are not increased by contraception. This is due to ovulation being driven by photoperiod and unique herd birthing patterns. Equid physiology is unique and not comparable to other wildlife such as white tailed deer where contraception increased out of season births in almost all cases.

Kirkpatrick, Jay F. 2005. "The Wild Horse Fertility Control Program." Humane Wildlife Solutions: The Role of Immunocontraception. Allen T. Rutburg. Humane Society of America. Humane Society Press, Washington D.C.
Mr. Kirkpatrick wrote this chapter of a book on Immunocontraception published by the Humane Society. Contains a history of fertility control in feral horses as well as a thorough description of the Assateague National Seashore wild horse program involving bi-annual remote darting for fertility control.

McCort, William. 1984. Behavior of Feral Horses and Ponies. Journal of Animal Science, Vol. 58, No. 2. pp 493-499.
An excellent summary of feral horse group behavior containing pertinent information on social groupings, home ranges, mating statistics, and mortality rates among foals (20-25% first year) and mature horses (86.6-97% survival).

Mehren, Michael J., Ph.D. 2009. Personal communication. American College of Animal Nutrition. September 2009.

In a telephone discussion with John McLain, discussed merits of oral contraceptives for use in wildlife population management. Dr. Mehren has worked extensively in the development of nutritional block supplements.

Miller, Lowell A., Ken Crane, Stan Gaddis, and Gary Killian. 2001. Porcine Zona Pellucida Immunocontraception: Long-Term Health Effects on White-Tailed Deer. Journal of Wildlife Management. 65(4):941-945.

Part of a nine year study on PZP treated does. Does were treated with PZP for the first two years of the study, estrus, weight, and condition were monitored for the following two years, and fertility *was observed for the remaining five years. Treated does did not show any sign of decreased fitness compared to control animals and all but one of the treated does returned to fertility after four to nine years. This study supports the hypothesis that PZP is a safe and effective population control method.*

Natural Resources Conservation Service (NRCS). 1984. Interim Report, Soil Survey of NE Kern Area, California, China Lake Naval Weapons Center Part. A cooperative project involving the Eastern Kern County RCD, Department of the Navy China Lake Weapons Center, and University of California Agricultural Experimental Station at Davis, California.

This interim report represents a limited soil survey conducted by the USDA NRCS for a small geographical area located just north of Ridgecrest, California. The surveyed area does fall within the NAWS-CL North Range but does not extend far enough north to include any portion of the Centennial HMA. This interim soil survey was produced from 1981 aerial photographs and the field inventory was conducted in 1984. This soil survey includes mapping of soil units and interpretations of the characteristics of the soil map units including: classification of soils, soil properties and soil management considerations including rangeland production. The acreage involved in this soil survey was not easily discernable in the report.

Natural Resources Conservation Service (NRCS). 1997. National range and pasture handbook. US Department of Agriculture. Washington DC. September 1997.

This comprehensive handbook specifies the methods and procedures approved by the USDA Natural Resources Conservation Service to be deployed by agency staff in providing conservation practices and services to private landowners or other federal agencies.

Nevada Cooperative Extension. 2007. Nevada rangeland monitoring handbook. 2nd edition. University of Nevada Reno, Reno, NV. Edu. Bull. 06-03.

Developed by an Interagency Technical Committee, this handbook identifies and describes recommended field methods for collecting, measuring and analyzing biological attributes and effects associated with livestock and/or ungulate grazing in Nevada.

Nunez, Cassandra M.V., James S. Adelman, Carolyn Mason, and Daniel Rubenstein. 2009. Immunocontraception decreases group fidelity in feral horse population during the non-breeding season. Applied Animal Behavior Science, 117 (2009) pp74-83.

A study of contracepted mare behavior during the non-breeding season. Indicates that mares that receive contraception and are not pregnant or nursing foals are more likely to visit other harem groups and to exhibit reproductive interest than control mare. This behavior may lead to instability in harem groups resulting in greater stress on all members. The authors suggest that, in herds treated with contraception, some mares should be left untreated and be allowed to foal, or potentially never treated, in order to maintain the inherent social structure.

Nunn, Gene. 2009. Personal Communication. October 18, 2009.

Mr. Nunn has been gathering wild horses from the Centennial herd for over 20 years on a professional basis. In a telephone call with Rex Cleary, he discussed gathering issues specific to this herd. His

determination was that, if the gatherers are diligent, an 80 percent gather should be possible.

Phillips, William. 2009. Personal Communication. Susanville BLM District Wild Horse Program Lead (Retired). July 31, 2009.
Discussed the methods used in the Modoc/Washoe Experimental Stewardship Program, which used structured herd management to select the wild horses to be left on public land and removed only the young and adoptable horses from the herd. This method eliminated the need to hold and feed large numbers of wild horses for the long term. Products from this interview include a current cost comparison of Gate-Cut vs. Structured Herd programs, costs of trucking, holding, and veterinary expenses.

Ricketts, Matthew J. 2004. Pryor Mountain Wild Horse Range Survey and Assessment. U.S. Department of Agriculture, Natural Resource Conservation Service, Bozeman, Montana. April, 2004.
Range assessment of the Pryor Mountains HMA. Indicates that the AML was set to high and did not consider that horses rarely use areas with slope higher than 50 percent. Recommends water improvement management for better dispersal and a reduction in the AML to approx 80 percent of current level.

Roelle, James, and Jason Ransom. 2009. Injection-Site Reactions in Wild Horses (*Equus caballus*) Receiving an Immunocontraceptive Vaccine. U.S. Geological Survey, Reston, Virginia: 2009
Indicates that the most efficient and least traumatic method for applying PZP is by hand-delivered injection of two-year pellets when horses are gathered (Pellets developed by the College of Medicine, University of Toledo.

Rudnick, R. 2009. Personal Communication. Onyx Ranch Owner/Operator. August 10, 2009.
Discussed the presents of horses in the Centennial herd area. Mr. Rudnick is the permittee of the Rudnick Common Allotment located adjacent to the NAWS-CL. His family has operated there for four generations.

Shepherd, Allen. 2009. Personal Communication. BLM Wild Horse and Burro Program, Research Administrator. October 21, 2009.
In a telephone conversation with Rachel Kozloski, Mr. Shepherd discussed the progress of fertility control programs within the BLM, as well as the implementation of the 2009 Instructional Memo on fertility control programs. Mr. Shepherd indicated his eagerness to work with the Navy to implement a fertility control program. He indicated that a management plan containing fertility control should be written and submitted for approval, just as it would be for a BLM managed herd, in order for inclusion in the BLM's PZP fertility control program.

Singer, F. J., and K. A. Schoenecker, compilers. 2000. Managers' summary Ecological studies of the Pryor Mountain Wild Horse Range, 1992-1997. U.S. Geological Survey, Midcontinent Ecological Science Center, Fort Collins, CO. 131 pp.
A compilation of numerous articles related to the Pryor Mountain Wild Horse Range. Section one deals with vegetation, section two with genetics, and section three with ecosystem modeling. Section two contains a great deal of detailed information on how genetic factors were calculated for the studies. Also contains a description of a model used to analyze genetic variability after years of different management strategies.
Siniff, Donald B., John R. Tester, and Gregory L. McMahon. 1986. Foaling Rate and Survival of Feral Horses in Western Nevada. Journal of Range Management. 39(4):296-298.
A small study of radio-collared mares in western Nevada. Number for foaling rates and mortality are too divergent to use; but, the study does show that the most productive age class for mares was at five to ten years old.

Swanson, S., et.al. 2006. Nevada rangeland monitoring handbook. 2nd ed. Univ. of Nevada Reno,

Cooperative Extension. Edu. Bull. 06-03.
This multiple-agency handbook describes accepted methods and procedures to monitor livestock grazing and other factors on rangelands located in the State of Nevada. This recent document provides an update and supersedes the first edition that was printed in 1984.

Tausch, R. 2009. Personal Communication. PHD, USFS Rocky Mountain Station. September 1, 2009.
Discussion regarding the effects of climate change on the migration of the Mojave Desert into the Great Basin.

Turner, J.W., Jr, I.K.M. Liu, and J.F. Kirkpatrick. 1996. Remotely delivered immunocontraception in free-roaming feral burros (*Equus asinus*). Journal of Reproduction and Fertility (1996) 107, 31-35.
Study using remotely delivered darts containing PZP on feral burros in the U.S. Virgin Islands. Demonstrates that PZP is effective on burros that breed year-round, can be delivered remotely, and is reversible.

Turner, John W., Irwin Liu, Douglas Flanagan, Allen Rutberg, and Jay Kirkpatrick. 2005. Immunocontraception in Wild Horses: One Inoculation Provides Two Years of Infertility. Journal of Wildlife Management. 71(2) 662-667.
Study using controlled release booster pellets to provide two+ years of reduced fertility from one vaccination. Among treated females, annual reproductive success from 2001 to 2004 sequentially was 5.9 percent, 14.0 percent, 32.0 percent, and 47.5 percent. Untreated females showed average reproductive success of 53.8± 1.3 percent across this period.

UNR. 2008. Great Basin Wildfire Forum – The Search for Solutions, Nevada Agricultural Experiment Station Bulletin, University of Nevada, Reno, April 2008.
A compendium of presentations on wildfire in the Great Basin. Excellent information on selection of species for revegetation and greenstrip work. Use of adapted species that are able to compete with cheatgrass in a post-fire ecosystem and, once established, can reduce the frequency of fires (as compared to cheatgrass).

USFWS. 2008. Horse and Burro Management at Sheldon National Wildlife Refuge: Finding of No Significant Impact. U.S. Fish and Wildlife Service, Portland, Oregon.
This document serves as a gather plan for the Sheldon National Wildlife Refuge, detailing the issues associated with maintaining a wild horse herd in a national wildlife refuge. Useful information includes a description of the levels of stress placed on horse during a helicopter gather, and details of an option to conduct adoptions directly from the refuge rather than through a contractor.

U.S. Navy. 1982. Draft Environmental Assessment: Interim Wild Horse Management Program. Naval Weapons Center, China Lake, California.
Provides insight into history of management actions related to wild horses and burros on the NAWS.

U.S. Navy. 2000. Integrated Natural Resources Management Plan 2000-2004, Draft, Naval Air Weapons Station, China Lake, Environmental Project Office, September.
Developed by the Environmental Project Office, this comprehensive plan was intended to establish resource and management planning processes, support a framework for daily land use and resource management, provide direction for resolution of land use conflicts or constraints, provide baseline descriptions of natural resources, and define resource management objectives and guidelines for the purpose of providing a viable framework for the management of natural resources at the Naval Air Weapons Station, China Lake. The scope of this land use plan included all lands held by the NAWS China Lake.

Vincent, Carol Hardy. 2005. CRS Report for Congress: Wild Horse and Burro Issues. RS22347. December 9, 2005.
Brief report prepared for congress. Contains valuable information on costs of gathering, holding, and adopting animals, as well as statistics on the number of animals gathered vs. the number of animals adopted for the years 1999 through 2005.

Winward, A.H. 2000. Monitoring the vegetation resources in riparian areas. USDA, Forest Service, Rocky Mtn. Res. Sta. Ogden, UT. Gen. Tech. Rep. RMRSGTR-47.
This document provides information on three sampling methods used to inventory and monitor the vegetation resources in riparian areas. The vegetation cross-section method evaluates the health of vegetation across the valley floor. The greenline method provides a measurement of the streamside vegetation. The woody species regeneration method measures the density and age class structure of any shrub or tree species that may be present in the sampling area. Together these three sampling procedures can provide an evaluation of the health of all the vegetation in a given riparian area.

Wockner, Gary, Francis Singer, and Kate Schoenecker. 2003. Habitat Suitability Model for Bighorn Sheep and Wild Horses in Bighorn Canyon and the Pryor Mountain Wild Horse Range. Natural Resource Ecology Lab, Colorado State University, Fort Collins, CO.
A description of grazing overlap between horses in the Pryor Mountains and Bighorn sheep. Indicates that, while horses and bighorns may graze on the same species, they remain spatially separated by preferred terrain.

Wood, Craig H.2002. Equine Facts: Body Condition Scoring for you Horse. University of Maine Cooperative Extension. Bulletin # 1010.
A review of the Henneke Body Condition scoring system. Horses receive a score of 1 to 9, reflecting the amount of fat deposition occurring in key areas. A horse receiving a 1 would be emaciated and a horse receiving a 9 would be extremely fat.

Young, J.A. and C. Clemments. 2009. "Cheatgrass – Fire and Forage on the Range", 2009, University of Nevada Press, Reno, Nevada.
Discussion of why cheatgrass is taking over in post fire ecosystems. Cheatgrass increases fire frequency to three to five years, which further reduces the ability of native and adapted species to compete. Includes information on cheatgrass as a forage species. Timing of grazing must be carefully considered.

Appendix E

Gather Methods

Horse and burro capture and removal will remain the primary population control effort and population management technique. Horse captures involving helicopters, roping, or run trapping typically must take place before the onset of foaling season, which begins in early March. More passive methods, such as water trapping, can be conducted throughout the year. It is anticipated that a variety of capture methods will be employed, depending on time of year, and horse or burro locations or concentrations. Capture methods are briefly summarized below.

A. Helicopter Roping Method

This method of gathering entails moving wild horses and burros to a roping site by helicopter. Entire groups or selected animals are then roped by wranglers on horseback. This method is almost always used to capture burros and has proved highly effective at capturing horses of specific confirmation or age, particularly when they occur in small widespread groups. This method is the primary method used in gathering operations conducted on the NAWS-CL in recent years. Despite its success, it poses several problems, which include increased safety hazards to the animals and personnel, and their saddle horses.

B. Helicopter Run Trap Method

This method of capturing wild horses involves constructing traps in locations where natural barriers and terrain play an important role in helping to funnel the wild horses into the trap. Helicopters are used to locate and drive wild horses into a run trap, which is typically placed along well-used trails. Once captured, a wild horse and burro specialist would determine sex, age and color; assess herd health (pregnancy/parasite loading/physical condition, etc.); sort individuals as to age, size, sex, temperament and/or physical condition, and select animals to be returned to the range. Herd composition data may be collected for the animals gathered and could later be incorporated into a population model for the herd. Excess wild horses would be transported to the BLM adoption preparation/holding facility in Ridgecrest and the remaining animals, if any, would be returned to the wild. This method is not currently considered suitable for the capture of burros due to their more wary nature and occurrence in small, widespread groups in rugged terrain.

C. Saddle Horse Method

With this method, riders locate and drive wild horses and burros into a trap or to an area where they can be roped. The success of this method depends on many factors including terrain, the nature of the animals, the distance herded, the number of riders on the drive, and the skill of the riders. This method differs from the helicopter run-in method in that no helicopter would be used to herd wild horses and burros, and there would likely be more trap sites and more saddle horses and riders needed to herd the animals. The number of traps and personnel and lack of efficiency would increase costs. This alternative as a primary method of gathering wild horses and burros increases the risk of injury to the rider and saddle horse. Injuries could occur away from vehicles, delaying treatment. It could also increase the incidence of separation of mares and colts as the ability to observe and respond to incidents would be lessened due to the lack of the helicopter and associated radio communications. It is also not likely that many animals could be effectively captured employing this method.

D. Bait or Water Trapping Method

This technique involves attracting horses or burros to an area using a mineral block, feed and water source, or any combination of these attractants. Traps are typically established at heavily used water sites and must allow for good vehicle access. Other nearby water sites may be temporarily fenced to force animals to utilize a trap site. Bait (hay or alfalfa) and salt/mineral/molasses blocks serve as additional incentives for animals to enter the traps.

Traps are typically constructed around a water source and left open until the animals become accustomed to entering the trap, at which time the gates/triggers are set. Trapped, targeted animals are transported to holding facilities for preparation for adoption. Traps must be checked at least on a daily basis. This method had proved effective for the capture of burros at heavily utilized water sources. Similar trapping efforts for horses are planned.

The BLM has suggested that permanent water/bait traps be installed. Captured animals could be selectively removed, contraceptives applied to mares, and studs removed and sent to long-term sanctuaries if funding were available.

Appendix F

Future Possibilities for Oral Contraception

Science has concentrated extensive research over the years regarding processes to bring about successful immunocontraception in America's wild horse population. Despite these attempts, with varying degrees of success, questions remain regarding the need to continually gather horses into traps for purpose of immunizing mares to avoid pregnancy and control herd size.

A significant part of the public opposes these gathers for a variety of reasons including the stress caused the animals and the propensity for occasional injuries. In addition, gathering wild horses is costly to conduct on a per head basis.

Information has been exchanged over the years regarding alternative approaches to immunocontraception, including use of nutrition as a means of applying contraception in mares. Some experts are of the opinion that a mineral block could potentially be developed that would target mares and prevent pregnancy. Theoretically, if successfully developed and tested, the responsible specialist could strategically distribute the mineral block in a Herd Management Areas (HMA) on an as needed basis to manage the herd population.

RCI contacted experts in the field of nutrition to ascertain if there might be potential in this approach, or if there has been research conducted in this area. Through recommendation, we contacted Dr. Dave Bohnert, livestock and ruminant nutrition specialist with University of Idaho who did not feel fully qualified to discuss this approach, despite his animal science background (Bohnert 2009, personal communication). He did indicate a concern that this approach might interfere with wildlife such as deer and perhaps other species. Dr. Bohnert strongly recommended that we visit with Dr. Michael Mehren, Diplomat, American College of Animal Nutrition, Hermiston, OR regarding this inquiry because of his qualifications and wide experience with equine nutrition.

Dr. Mehren showed strong interest in the concept and felt that science could possibly accomplish this challenge if they could identify the compound to do the job (Mehren 2009, personal communication). Mehren further felt it necessary to locate an equine physiologist along with 2-3 other respected scientists, possibly members of the Equine Society, to address this challenge. He also felt that targeting mares without impacting other species make it even more challenging, as it would be necessary to find compounds peculiar to horses that other critters don't react to. Dr. Mehren expressed an interest in continuing conversation in this regard. He also would be interested in possible participation if such study were to evolve in the future, as he is fully aware of the extensive costs associated with the wild horse program and the limitations in the current immunocontraception program.

RCI feels that NAWS, if interested, may present a unique opportunity with its wild horse population, off limits facility, and staff of concerned biologists, to consider a research study relating to immunocontraception through use of a targeted mineral block. BLM might also become a participant in such research, given the issues and challenges that they face with the WH&B program nationwide.

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Appendix G

Fertility Control

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
WASHINGTON, D.C. 20240

March 12, 2009

In Reply Refer To:
4710 (260) P

EMS TRANSMISSION 03/17/2009
Instruction Memorandum No. 2009-090
Expires: 09/30/2010

To: All Field Officials (except Alaska)
From: Assistant Director, Renewable Resources and Planning

Subject: Population-Level Fertility Control Field Trials: Herd Management Area (HMA) Selection, Vaccine Application, Monitoring and Reporting Requirements

Program Area: Wild Horse and Burro Program

Purpose: The purpose of this Instruction Memorandum is to establish guidance for population-level fertility control field research trials. The primary objective of these trials is to evaluate the effects of a single year or 22-month Porcine Zona Pellucida (PZP) immunocontraceptive vaccine treatment on wild horse population growth rates while expanding the use of these tools in the field.

Policy/Action: This policy establishes guidelines for selecting HMAs for population-level fertility control treatment, vaccine application, and post-treatment monitoring and reporting. It is the policy of the BLM to apply fertility control as a component of all gathers unless there is a compelling management reason not to do so.

HMA Selection

Managers are directed to explore options for fertility control trials in all HMAs or complexes when they are scheduled for gathers. Further, an alternative outlining implementation of a fertility control treatment under a population-level research trial shall be analyzed in all gather plan EAs. Attachment 1 contains the Standard Operating Procedures (SOPs) for the implementation of the single-year and 22-month PZP agents, which should be referenced in the EA.

Fertility control should not be used in a manner that would threaten the health of individual animals or the long-term viability of any herd. In order to address the latter requirement, managers must evaluate the potential effects of fertility control on herd growth rates through use of the Jenkins Population Model (WinEquus). Fertility control application should achieve a substantial treatment effect while maintaining some long-term population growth to mitigate the effects of potential environmental catastrophes.

Fertility control will have the greatest beneficial impact where:

1. Annual herd growth rates are typically greater than five percent.
2. Post-gather herd size is estimated to be greater than 50 animals.
3. Treatment of at least 50 percent of all breeding-age mares within the herd is possible using either application in conjunction with gathers or remote delivery (darting). A maximum of 90 percent of all mares should be treated and our goal should be to achieve as close as to this percentage as possible in order to maximize treatment effects.

Fertility control should not be dismissed as a potential management action even if the above conditions are not met. Regardless of primary capture method (helicopter drive-trapping or bait/water trapping); managers should strive to gather horses in sufficient numbers to achieve the goals of the management action, such as selective removal and fertility control treatment. After decisions are made to apply fertility control, historical herd information, remote darting success (if employed) and post-gather herd demographic data must be reported to the National Program Office (NPO). See the Reporting Requirements section on page four.

Vaccine Application and Animal Identification at Gather Sites Using the 22-Month Vaccine

Once an HMA has been selected as a population-level field trial site, the NPO will designate a trained applicator to administer the vaccine during the scheduled gather. The applicator will be responsible for securing the necessary vaccine from the NPO, transporting all application materials and freeze-marking equipment to the gather site, administering the treatment, and filing a treatment report with the NPO. See Attachment 1 for SOP for Population-level Fertility Control Treatments.

All treated mares will be freeze-marked with two 3.5-inch letters on the left hip for treatment tracking purposes. The only exception to this requirement is when each treated mare can be clearly and specifically identified through photographs. The treatment letters will be assigned and provided by the NPO after the gather and fertility control application is approved by the authorized officer. A different first letter is assigned for each fiscal year starting with fiscal year 2004 and the letter "A." The second letter of the freeze-mark is specific to the application.

Each BLM State Office (SO) is responsible for coordinating with the State Brand Inspector on the use of the identified two-letter freeze-mark. Based on this coordination, possible alternatives or additions to this marking policy are listed below:

1. Use of the adult or foal size angle-numeric BLM freezemark on the neck while recording each treatment product and date with the individual horse's freezemark number.
2. Registration of the BLM fertility control hip mark.
3. Use of a registered brand furnished by the State.
4. Use of the same hip freeze-mark for all fertility control treatments within that State's jurisdiction plus an additional freeze-mark on the neck to differentiate between treatments within the State.
5. Use of the NPO assigned freeze-mark plus additional freeze-mark on the neck to differentiate between treatments within the State.

As an example, the Nevada State Brand Inspector requires that an "F" freeze-mark be applied to the left neck along with the two-letter hip mark assigned by NPO.

Regardless of how the mares are marked, the marks must be identified in the fertility control treatment report in order to track when the mares were treated and the treatment protocol used.

Mares may be considered for re-treatment during subsequent gathers. All re-treatments will consist of the multi-year vaccine unless specifically approved by the NPO. Any re-treated mares must be re-marked or clearly identifiable for future information.

Vaccine Application and Animal Identification Using Remote Delivery (Darting)

Remote delivery of the one year vaccine by a trained darter/applicator will be considered and approved only when (1) application of the current 22-month PZP agent is not feasible because a gather will not be conducted, and (2) the targeted animals can be clearly and specifically identified on an on-going basis through photographs and/or markings. No animals should be darted that cannot be clearly and positively identified later as a treated animal. To increase the success rate of the darting and to insure proper placement of the vaccine, darting should occur along travel corridors or at water sources. If necessary, bait stations using hay or salt may be utilized to draw the horses into specific areas for treatment. The applicator will maintain records containing the basic information on the color and markings of the mare

darted and her photographs, darting location, and whether the used darts were recovered from the field. See Appendix 1 for SOP for Population-Level Fertility Control Treatments.

Post-treatment Monitoring

At a minimum, the standard data collected on each treated herd will include one aerial population survey prior to any subsequent gather. This flight will generally occur three to four years after the fertility control treatment and will be conducted as a routine pre-gather inventory funded by the Field Office (FO). The flight should be timed to assure that the majority of foaling is completed, which for most herds will require that flights be scheduled after August 1st. In addition to pre-gather population data (herd size), information on past removals, sex ratio, and age structure (capture data) will be submitted to the NPO after the first post-treatment gather.

The following standard data will be collected during all post-treatment population surveys:

1. Total number of adult (yearling and older) horses observed.
2. Total number of foals observed.

These data are to be recorded on the Aerial Survey Report form (Attachment 4). In planning post-treatment population surveys, the new population estimation techniques being developed by U.S. Geological Survey (USGS) are strongly recommended. In general, however, it is not necessary that anyone try to identify treated and untreated mares and specifically which mares have foaled during aerial surveys.

To obtain more specific information on vaccine efficacy, some HMAs may be selected for intensive monitoring beginning the first year after treatment and ending with the first gather that follows treatment. These surveys should be completed annually within the same month for consistency of the data. Selection will be based on the proportion of treated mares in the herd, degree of success with vaccine application, degree to which HMA selection criteria are met, and opportunities for good quality data collection. This determination will be made by the WH&B Research Advisory Team and the NPO in consultation with the appropriate Field Office (FO) and State Office (SO). HMAs selected for intensive monitoring will be identified in that specific State's Annual Work Plan. Washington Office 260 (WO260) will provide funding for the annual surveys in those HMAs selected for intensive monitoring.

Field Office personnel may conduct more intensive on-the-ground field monitoring of these herds as time and budget allow. These data should be limited to: 1) the annual number of marked and unmarked mares with and without foals and 2) foaling seasonality. These data, generated for FO use, should be submitted to the NPO to supplement research by the USGS.

Reporting Requirements

1) When an HMA is selected for fertility control treatment, the HMA manager will initiate and complete the appropriate sections of the Gather, Removal, and Treatment Summary Report (Attachment 2) and submit the report to the NPO. At the conclusion of the gather and treatment, the HMA manager will complete the remainder of the Gather, Removal, and Treatment Summary Report and submit it to the NPO within 30 days. The NPO will file and maintain these reports, with a copy sent to the National WH&B Research Coordinator.

2) Following treatment, the fertility control applicator will complete a PZP Application Report and PZP Application Data Sheet (Attachments 3 & 4) and submit it to the NPO that summarizes the treatment. The NPO will maintain this information and provide copies of the reports to appropriate FOs and USGS.

3) Managers are required to send post-treatment monitoring data (Aerial Survey Report, Attachment 5) to the NPO within 30 days of completing each aerial survey. Any additional on-the-ground monitoring data should be sent to the NPO on an annual basis by December 31st.

4) During the next post-treatment gather (generally four to six years after treatment), the manager will complete a new Gather, Removal, and Treatment Summary Report with pertinent information and submit the report to the NPO. Completion of this report will fulfill the requirements for monitoring and reporting

for each population-level study. A possible exception would be if mares are treated (or re-treated) and the HMA is retained as a population-level study herd.

The USGS will analyze all standard data collected. The results of these analyses along with other research efforts will help determine the future use of PZP fertility control for management of wild horse herds by the BLM.

Timeframe: This Instruction Memorandum is effective upon issuance.

Budget Impact: Implementation of this policy will achieve cost savings by reducing the numbers of excess animals removed from the range and minimizing the numbers of less adoptable animals removed. The costs to administer the one-year PZP agent include the labor and equipment costs for the applicator and assistant of roughly $4,000/month and the treatment cost of approximately $25 per animal. The costs to administer the 22-month PZP agent include the capture cost of about $1,000 per animal treated (under normal sex ratios it requires two horses, one stud and one mare, to be captured for each mare treated) and the PZP vaccine is approximately $250 per animal. The budgetary savings for each foal not born due to fertility control is about $500 for capture, $1,100 for adoption prep and short-term holding, $500-1,000 for adoption costs, and approximately $475 per year for long-term holding of animals removed but not adopted. For each animal that would have been maintained at long term holding for the remainder of its life after capture, the total cost savings is about $13,000. Any additional FO-level monitoring will be accomplished while conducting other routine field activities at no additional cost.

Population-level studies will help to further evaluate the effectiveness of fertility control in wild horse herds. Recent research results showed that application of the current 22-month PZP contraceptive appears capable of reducing operating costs for managing wild horse populations. Application of a three to four year contraceptive, when developed, tested, and available, may be capable of reducing operating costs by even more (Bartholow 2004).

Background: The one-year PZP vaccine has been used with success on the Pryor Mountain and the Little Book Cliffs Wild Horse Ranges. The 22-month PZP vaccine has been administered to 1,808 wild horse mares in 47 HMAs since fiscal year 2004**.** This formulation has been shown to provide infertility potentially through the third year post-treatment as determined by a trial conducted at the Clan Alpine HMA in 1999. The intent of the ongoing population-level fertility control trials is to determine if the rate of population growth in wild horse herds can be reduced through the use of the currently available 22-month time-release PZP vaccine, applied within a three to four year gather and treatment cycle. Monitoring data collected over the next few years are essential to determine the effectiveness of the vaccine when applied on a broad scale as well as its potential for management use.

PZP is classified as an Investigational New Animal Drug and some level of monitoring will continue to be required until such time as the Food and Drug Administration (FDA) or the Environmental Protection Agency (EPA) either reclassify the vaccine or provide some other form of relief.

Manual/Handbook Sections Affected: The monitoring requirements do not change or affect any manual or handbook.

Coordination: The requirements outlined in this policy have been evaluated by the National Wild Horse and Burro Research Advisory Team, coordinated with the National Wild Horse and Burro Advisory Board, and reviewed by Field Specialists.

Contact: Questions concerning this policy should be directed to Alan Shepherd, WH&B Research Coordinator at the Wyoming State Office in Cheyenne, Wyoming at (307) 775-6097.

Reference: Bartholow**, J.M. 2004.** An economic analysis of alternative fertility control and associated management techniques for three BLM wild horse herds**.** Fort Collins, CO: U.S. Geological Survey. Open-File Report 2004-1199. 33 p.

Signed by:
Edwin L. Roberson
Assistant Director
Renewable Resources and Planning

Authenticated by:
Robert M. Williams
Division of IRM Governance, WO-560

5 Attachments
1- Standard Operating Procedure for Population 0 level Fertility Control Treatments (2 pp)
2- Gather Removal, and Treatment Report (3 pp)
3- PZP Application Report (1 p)
4- PZP Application Data Sheet (1 p)
5- Aerial Survey Report (1 p)

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Attachment 1: Standard Operating Procedures for Population-level Fertility Control Treatments

One-year liquid vaccine:

The following implementation and monitoring requirements are part of the Proposed Action:

1. PZP vaccine would be administered through darting by trained BLM personnel or collaborating research partners only. For any darting operation, the designated personnel must have successfully completed a Nationally recognized wildlife darting course and who have documented and successful experience darting wildlife under field conditions.
2. Mares that have never been treated would receive 0.5 cc of PZP vaccine emulsified with 0.5 cc of Freund's Modified Adjuvant (FMA) and loaded into darts at the time a decision has been made to dart a specific mare. Mares identified for re-treatment receive 0.5 cc of the PZP vaccine emulsified with 0.5 cc of Freund's Incomplete Adjuvant (FIA).
3. The liquid dose of PZP vaccine is administered using 1.0 cc Pneu-Darts with 1.5" barbless needles fired from either Dan Inject® or Pneu-Dart® capture gun.
4. Only designated darters would mix the vaccine/adjuvant and prepare the emulsion. Vaccine-adjuvant emulsion would be loaded into darts at the darting site and delivered by means of a capture gun.
5. Delivery of the vaccine would be by intramuscular injection into the left or right hip/gluteal muscles while the mare is standing still.
6. Safety for both humans and the horse is the foremost consideration in deciding to dart a mare. The Dan Inject® gun would not be used at ranges in excess of 30 m while the Pneu-Dart® capture gun would not be used over 50 m, and no attempt would be taken when other persons are within a 30-m radius of the target animal.
7. No attempts would be taken in high wind or when the horse is standing at an angle where the dart could miss the hip/gluteal region and hit the rib cage. The ideal is when the dart would strike the skin of the horse at a perfect 90° angle.
8. If a loaded dart is not used within two hours of the time of loading, the contents would be transferred to a new dart before attempting another horse. If the dart is not used before the end of the day, it would be stored under refrigeration and the contents transferred to another dart the next day. Refrigerated darts would not be used in the field.
9. No more than two people should be present at the time of a darting. The second person is responsible for locating fired darts. The second person should also be responsible for identifying the horse and keeping onlookers at a safe distance.
10. To the extent possible, all darting would be carried out in a discrete manner. However, if darting is to be done within view of non-participants or members of the public, an explanation of the nature of the project would be carried out either immediately before or after the darting.
11. Attempts will be made to recover all darts. To the extent possible, all darts which are discharged and drop from the horse at the darting site would be recovered before another darting occurs. In exceptional situations, the site of a lost dart may be noted and marked, and recovery efforts made at a later time. All discharged darts would be examined after recovery in order to determine if the charge fired and the plunger fully expelled the vaccine.
12. All mares targeted for treatment will be clearly identifiable through photographs to enable researchers and HMA managers to positively identify the animals during the research project and at the time of removal during subsequent gathers.
13. Personnel conducting darting operations should be equipped with a two-way radio or cell phone to provide a communications link with the Project Veterinarian for advice and/or assistance. In the event of a veterinary emergency, darting personnel would immediately contact the Project Veterinarian, providing all available information concerning the nature and location of the incident.

14. In the event that a dart strikes a bone or imbeds in soft tissue and does not dislodge, the darter would follow the affected horse until the dart falls out or the horse can no longer be found. The darter would be responsible for daily observation of the horse until the situation is resolved.

22-month time-release pelleted vaccine:

The following implementation and monitoring requirements are part of the Proposed Action:

1. PZP vaccine would be administered only by trained BLM personnel or collaborating research partners.
2. The fertility control drug is administered with two separate injections: (1) a liquid dose of PZP is administered using an 18-gauge needle primarily by hand injection; (2) the pellets are preloaded into a 14-gauge needle. These are delivered using a modified syringe and jabstick to inject the pellets into the gluteal muscles of the mares being returned to the range. The pellets are designed to release PZP over time similar to a time-release cold capsule.
3. Delivery of the vaccine would be by intramuscular injection into the gluteal muscles while the mare is restrained in a working chute. The primer would consist of 0.5 cc of liquid PZP emulsified with 0.5 cc of Freunds Modified Adjuvant (FMA). The pellets would be loaded into the jabstick for the second injection. With each injection, the liquid or pellets would be injected into the left hind quarters of the mare, above the imaginary line that connects the point of the hip (hook bone) and the point of the buttocks (pin bone).
4. In the future, the vaccine may be administered remotely using an approved long range darting protocol and delivery system if or when that technology is developed.
5. All treated mares will be freeze-marked on the hip or neck HMA managers to positively identify the animals during the research project and at the time of removal during subsequent gathers.

Monitoring and Tracking of Treatments:

1. At a minimum, estimation of population growth rates using helicopter or fixed-wing surveys will be conducted before any subsequent gather. During these surveys it is not necessary to identify which foals were born to which mares; only an estimate of population growth is needed (i.e. # of foals to # of adults).
2. Population growth rates of herds selected for intensive monitoring will be estimated every year post-treatment using helicopter or fixed-wing surveys. During these surveys it is not necessary to identify which foals were born to which mares, only an estimate of population growth is needed (i.e. # of foals to # of adults). If, during routine HMA field monitoring (on-the-ground), data describing mare to foal ratios can be collected, these data should also be shared with the NPO for possible analysis by the USGS.
3. A PZP Application Data sheet will be used by field applicators to record all pertinent data relating to identification of the mare (including photographs if mares are not freeze-marked) and date of treatment. Each applicator will submit a PZP Application Report and accompanying narrative and data sheets will be forwarded to the NPO (Reno, Nevada). A copy of the form and data sheets and any photos taken will be maintained at the field office.
4. A tracking system will be maintained by NPO detailing the quantity of PZP issued, the quantity used, disposition of any unused PZP, the number of treated mares by HMA, field office, and State along with the freeze-mark(s) applied by HMA and date.

Attachment 2: Gather, Removal and Treatment Summary Report

Table 1 should be filled out when a gather operation and/or PZP field trial is conducted. Table 2 should be completed daily and submitted to WO, NPO, State Office and Field Office representatives in order to monitor gather progress. The totals from Table 2 are used to complete the pertinent sections in Table 1. A separate report should be completed for each HMA gathered.

Directions for completing Table 1:

1. Routine gather and removal - Fill out Sections A through D.
2. Gather with fertility control treatment - Fill out Sections A through E.
3. Fertility control treatment through remote darting – Fill out Sections A, B, and E.
4. As additional follow-up aerial population inventory information is collected, simply add it to the form in Section F.

Table 1. Gather, Removal, and Treatment Summary

Section A.						
HMA Name / #		Subpopulation Name				
State		Field Office				
Person Submitting Report	Name: Phone: Email:					
Section B. Pre-gather Survey Information	Date(s) of survey:					
(1) Estimated number of adults in population						
(2) Estimated number of foals in population						
(3) Estimated average annual population increase over last five years (%)						
(4) Historic foaling season (months of … to …)						
Section C. Gather Information	Date(s) of gather:		Studs	Mares	Foals	Total
(5) Number of animals gathered						
(6) Estimated number of animals not gathered						
(7) Total estimated pre-gather herd size (line 5 plus line 6)						
Section D. Removal Information						
(8) Number of animals removed[1]						
(9) Number of animals died/euthanized – Gather Related[2]						
(10) Number of animals died/euthanized – Not Gather Related[3]						
(11) Number of animals returned to range (line 5 minus sum of lines 8 - 10)						
(12) Total post-removal herd size (line 6 plus line 11)						
Section E. PZP Treatment Information	Date(s) of treatment:					
(13) Number of mares treated and released[4]						
(14) Number of untreated mares in post-removal herd (should equal line 6)[4]						
(15) Number of darts fired (if applicable)						
(16) Number of darts not recovered (if applicable)						
Section F. Post-gather/treatment Population Survey Information[5]						
Date(s) of Survey	Number of Adults	Number of Foals	Total Herd Size			

[1] The number of animals removed should include those animals shipped to BLM prep/holding facilities for adoption/holding, estray animals and any orphan foals fostered with volunteers. Please explain if necessary in narrative below.

[2] The number of animals that died or were euthanized due to acute injuries or medical conditions brought about by the gather and removal process including those that occurred during capture, sorting and holding at the gather site. This would include all animals that died for known or unknown reasons thought to be related to gather activities. Please explain how or why each animal died or was euthanized in narrative form below.

[3] Enter the number of animals that died or were euthanized for reasons related to chronic or pre-existing conditions such as body condition, lameness, serious physical defects, etc.. This would include animals that were euthanized for conditions not brought about by the gather activity. Please explain how or why each animal died or was euthanized in narrative form below.

[4] The sum of lines 13 and 14 should equal the number of mares on line 12. Number must match the number shown on the PZP Application Report.

[5] Population survey information for inventories completed after gather and/or treatment described above in Sections A-E. If any animals were removed from HMA during the years after gather and/or treatment described above, please note the number (studs, mares, foals) and date(s) removed in this section as well.

Table 2. Daily Gather Activity Log[1]

HMA Name / #								HMA Complex						
State / Field Office								Dates of Gather						
	# Gathered				# Removed[2]				# Release back to HMA				Died/Euthanized (Gather related)[3]	Died/Euthanized (Not Gather Related)[4]	# Fertility Treated Mares[5]
Date	Stud	Mare	Foal	Total	Stud	Mare	Foal	Total	Stud	Mare	Foal	Total			
Totals[6]															

[1] The Gather Activity Log should be filled out daily and submitted to WO, NPO, State Office and Field Office representatives in order to monitor gather progress. The totals from Table 2 are used to complete the pertinent sections in Table 1. The information contained within the Daily Log also corresponds to gather contract pay items within the COR Contract Diaries.

[2] The number of animals removed should include those animals shipped to BLM prep/holding facilities for adoption/holding, estray animals and any orphan foals fostered with volunteers. Please explain if necessary in narrative below.

[3] The number of animals that died or were euthanized due to acute injuries or medical conditions brought about by the gather and removal process including those that occurred during capture, sorting and holding at the gather site. This would include all animals that died for known or unknown reasons thought to be related to gather activities. Please provide a description of animal (age, sex, physical condition) and explain how or why each animal died or was euthanized in narrative form below.

[4] Enter the number of animals that died or were euthanized for reasons related to chronic or pre-existing conditions such as body condition, lameness, serious physical defects, etc.. This would include animals that were euthanized for conditions not brought about by the gather activity. Please provide a description of animal (age, sex, physical condition) and explain how or why each animal died or was euthanized in narrative form below.

[5] The number shown must match the PZP Application Report.

[6] The totals will be used to complete the appropriate sections of the Gather, Removal, and Treatment Summary (Table 1).

NARRATIVE / COMMENTS

Gather, Removal, and Treatment Summary

Please provide a narrative describing the important aspects of the gather, including but not limited to costs, list of animals died/euthanized and reasons, and any estray animals gathered. If this is the first gather post fertility control treatment, please provide information in this narrative on the number of treated mares captured, physical condition, and if they were retreated or removed as excess animals.

Daily Gather Activity Summary

These are daily comments on the progress of the gather, problems, or other significant information. The cause of death or reason for euthanasia must be described for each horse affected.

Revised 11/25/08

Attachment 3: PZP Application Report

HMA Name /#		Subpopulation Name	
State		Field Office	
Certified Applicator	Name: Phone: Email:		
Application Date(s)			
Primer/Booster PZP Dose: Adjuvant Type: Adjuvant Dose:		Time release pellets Process: Hot / Cold /Pressure-molded (circle) Batch #:	
Delivery method:	Hand injection or Dart (circle type)	Injection Site	
Dart delivery device used	Dan Inject or Pneu-dart (circle type)	Number of darts recovered (if applicable)	
Freeze-mark Used		Freeze-mark Location	
Number of Treated Mares Returned to the Range		Number of Non-Treated Mares Returned to the Range	

Please provide a narrative description of the PZP treatment and procedures, implementation costs, and any loss of vaccine, if applicable. This narrative should include all pertinent sections of the old PZP Applicator's Report.

Revised 04/02/08

Attachment 4: PZP Application Data Sheet

<table>
<tr><td colspan="2">HMA Name</td><td colspan="2"></td><td>HMA #</td><td></td></tr>
<tr><td colspan="2">Applicator</td><td colspan="2"></td><td>Date(s)</td><td></td></tr>
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Optional Photo #</td><td colspan="2">Comments – Unique Marks or
Conditions</td></tr>
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Revised 11/25/08

Attachment 5: Aerial Survey Report

HMA Name / #		Subpopulation Name	
State		Field Office	
Report Submitted By	Name: Phone: Email:		
Survey Date(s)		Aircraft Make and Model	
Name of observers			
Weather			
Altitude of Flight		Total Flight Time	
Purpose of Survey (check one)	_____ Pre-gather and/or Pre-PZP Treatment _____ Post-gather and/or Post-PZP Treatment		
Survey Method Used (check one)	_____ Direct Count _____ Simultaneous Double Count _____ Photo-Mark - Resight		

Survey Results

	Adults	Foals
(1) Number Counted		
(2) Estimated Number Uncounted		
(3) Total Number on the Range[1]		
(4) Population Estimate (Confidence Interval, CI). To be filled in following statistical modeling of population data collected during inventory flight.		

[1]Line (3) should equal line (1) plus line (2).

Please write a brief narrative describing the methodology and results. Include as much detail as you deem important, but be sure to include a description of the flight pattern (e.g., transect spacing and direction), identification of a pre-flight population estimate, and protocol (e.g., each observer counted animals only on one side of the aircraft). Also, please provide any other comments that might be relevant in interpreting the data. If there were no changes from the previous aerial survey, simply provide the date of the flight and indicate "no changes."

Appendix H

BLM Genetic Sampling Protocol

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
WASHINGTON, D.C. 20240
http://www.blm.gov

January 15, 2009

In Reply Refer To:
4710 (260) P

EMS TRANSMISSION 01/15/2009
Instruction Memorandum No. 2009-062
Expires: 09/30/2010

To: All Field Officials (except Alaska)
From: Assistant Director, Renewable Resources and Planning

Subject: Wild Horse and Burro Genetic Baseline Sampling

Program Area: Wild Horse and Burro Program

Purpose: This Instruction Memorandum (IM) establishes program guidance and policy for the collection of genetic baseline information for wild horse and burro populations. This data will be beneficial to authorized officers and field specialists that are responsible for herd management decisions.

Policy/Action: The Wild Free-Roaming Horse and Burro Act requires that horses and burros on public lands be managed in a manner that achieves and maintains thriving ecological balance. Maintenance of such a balance frequently requires that wild horse populations be kept small. When population size is too small, it will inevitably lead to decreased genetic variation and possible inbreeding. However, it is possible to manage small populations in a manner that will minimize the loss of variation and inbreeding and if necessary, counteract the loss. The first step in this process is an assessment of the current genetic status of the population that will be followed by periodic monitoring assessments.

Genetic marker analysis can provide information about both the past and the future of a population. Because gene markers are passed from one generation to the next, they can tell us something about the ancestry of a population. Also, because demographics can affect the distribution of genetic markers within a population, these markers can often be used to interpret past population characteristics. In the same way, current demographic conditions can be used to make predictions about the future level of variability of gene markers.

Prior to 2006, blood samples from wild horses and burros were collected during gather operations and analyzed by Dr. Gus Cothran (University of Kentucky) for establishing baseline genetic data. With Dr. Cothran's move to Texas A&M University, this analysis is now being done using hair samples. A new baseline does not need to be established through hair analysis if blood analysis has already been completed. Unless there is a previously recognized concern regarding low genetic diversity in a particular herd, it is not necessary to collect genetic information at every gather. Typical herds should be sampled every ten to 15 years (two to three gather cycles). Following processing, a sample of DNA will be preserved (frozen) for each horse tested. A report on the analysis of the population will be provided by Dr. Cothran. Reports are to be kept on file at local Field Offices and also at the National Program Office. Attachment 1 contains the instructions for collecting, handling, and shipping of the hair samples.

While it is preferred to collect the hair samples from horses or burros that are released back to the herd management area (HMA), samples may also be collected from removed horses if necessary. In complexes or HMAs where separate breeding populations are thought to exist, each group of animals in a distinct population should be sampled separately. Do not mix samples from different horses or different breeding populations. Mixing samples from non-interbreeding herds can give misleading estimates of genetic variation. Minimum sample size is 25 animals or 25 percent of the post-gather population, not to exceed 100 animals per HMA or separate breeding population. Samples should be collected from males and females in the same approximate ratio as the population. Animals of any age class may be sampled. Burros should be sampled in the same manner as horses.

The data will be compared to similar data from both domestic and other wild horse/burro populations. The primary value of this initial data is a baseline against which future samples can be compared to identify genetic drift and any narrowing of diversity through inbreeding. In the short term, genetic diversity can be determined, rare alleles identified and historic origins of and relationships among herds can be implied.

Timeframe: This IM is effective upon issuance.

Budget Impact: Costs associated with implementation of this IM will include the Bureau of Land Management (BLM) labor for collection of samples as well as sample processing and analysis at Texas A&M University. It is anticipated that costs for processing each sample will be $25-30 per sample while the analysis and reporting is estimated at $300 per report.

Background: The BLM has been collecting genetic health information about its wild horse and burro populations since the early 1990s. To date, approximately 75 percent of the 199 HMAs that BLM administers have been tested and many have been retested. Based on this data, inbreeding is apparently rare in wild horse populations. Most wild horse herds that have been sampled exhibit moderate levels of genetic heterozygosity. Based on this analysis, approximately 12.5 percent of the herds tested have heterozygosity levels (observed heterozygosity (Ho)) below the assumed critical level of .310. These are herds that could begin to show inbreeding effects. Approximately 15 percent of the herds tested are within just two percent heterozygosity (.330) of the critical level. A population that is maintained at less than 100-120 adult animals may begin to lose variation fairly quickly. The herds that are just above the critical threshold level could drop very quickly. Only a very small number (approximately 5) of the 199 HMAs have exhibited characteristics possibly attributable to inbreeding, such as cataract blindness, dwarfism, parrot-mouth, or club-foot deformities. Thus, there does not appear to be any immediate cause for concern about inbreeding depression in wild horse herds.

Manual/Handbook Sections Affected: These monitoring requirements will be incorporated into 4710 handbook. This policy is consistent with the Strategic Research Plan – Wild Horse and Burro Management.

Coordination: The requirements outlined in this policy have been evaluated by the Wild Horse and Burro Research Advisory Team, reviewed by Field Specialists and coordinated with the National Wild Horse and Burro Advisory Board.

Contact: Questions concerning this policy should be directed to Alan Shepherd, Wild Horse and Burro Research Coordinator, at the Wyoming State Office (307) 775-6097.

Signed by:
Edwin L. Roberson
Assistant Director
Renewable Resources and Planning

Authenticated by:
Robert M. Williams
Division of IRM Governance, WO-560

1 Attachment
1- Genetics Data Collection Instructions (2 pp)

Attachment 1: Genetics Data Collection Instructions

Analysis of DNA to determine genetic diversity of wild horse and burro (WH&B) herds is now being done using hair samples rather than blood samples. Unless there is a previously recognized concern regarding low genetic diversity in a particular herd, it is not necessary to collect genetic information at every gather. Typical herds should be sampled every 10-15 years. A new baseline does not need to be established through hair analysis if blood analysis has already been completed. Please follow the instructions below for collecting the hair samples and call Alan Shepherd, WH&B Research Coordinator, if you have any questions.

While it is preferred to sample release horses you may also sample removed horses if necessary. In complexes or HMAs where separate breeding populations are thought to exist, each group of animals in a distinct population should be sampled separately. Do not mix samples from different horses or different breeding populations. Minimum sample size is 25 animals or 25% of the post-gather population, not to exceed 100 animals per population. Samples should be collected from males and females in the same approximate ratio as the population. Animals of any age class may be sampled. Burros should be sampled in the same manner as horses.

1) You will need one plain white paper envelope, a white #10 business envelop works best, for each horse. Do NOT routinely use plastic or zip-lock bags; do NOT use plastic coated envelopes or envelopes with windows in them.

2) Hair samples must be obtained by pulling the hair NOT cutting or shaving it off the horse. The DNA is in the root follicle not the hair itself. Mane hair will work, but on foals or young horses you may need to obtain tail hair. Please submit about 30 hairs per animal. A bundle of 30 hairs is about the diameter of a pencil.

The easiest way to pull a good sample is to grasp a bundle of hair and wrap it around a clean mane comb or hoof pick. Holding the bundle close to the neck, pull *straight out* firmly. Foal hair is more brittle and tends to break off. If you are having trouble getting hair with the root attached try obtaining a tail hair sample instead.

3) Check that you have the hair roots or hair bulbs attached to the hair at the base. They feel like little bumps on the end of each hair.

Keep the hair in a loose bundle pointed in one direction or twist it together and place it in an envelope. You can cut off excess hair and leave only a few inches with the hair root attached to put in the envelop if that is easier.

(James Sturdivant – The Jockey Club, modified with permission)

4) Seal the envelope and *write the sample number on the envelope*. Write the sample number along with the horse's color, sex and age on the data collection sheet. If animals cannot be aged in years, at least record adult, yearling or foal. Keep stray hairs out of the comb and off your clothes so they don't contaminate the next sample.

Please NOTE: It is best to sample when the hair is dry. If you need to sample when it is raining or the horses are wet, then DO use zip-lock bags for each sample AND keep the samples cool not frozen (refrigerate then shipped with cold packs) until they arrive at the lab.

Please fill out the top of the form completely, including the HMA number and date the sample was collected. Within 3 days of the end of the gather *send a copy of the data collection form to Attn:Alan Shepherd c/o Wyoming State Office and FEDEX the samples, to arrive on a weekday not the weekend with the Data Collection Sheet to Dr. Gus Cothran, address below*.

Dr. E. Gus Cothran
VIBS, CVM
TAMU4458
Texas A&M University
College Station, TX 77843
Phone (979) 845-0229

For questions or comments, contact:
Alan Shepherd, WY BLM 307-775-6097
or
the National Program Office at 775-861-6583

HAIR SAMPLE GENETICS DATA COLLECTION SHEET
WILD HORSE AND BURRO HERD GENETICS EVALUATION **PAGE _____ OF _____**

HMA: _____ HMA #: _____ DATE: _____

TRAP/SUBGROUP: _____ F/O: _____ STATE:_____

BLM CONTACT PERSON: _____ PHONE: _____

ADDRESS : _____

EMAIL: _____ SAMPLED HORSES WERE (circle) RELEASED or REMOVED

	SAMPLE #	COLOR	SEX	AGE	COMMENTS
1					
2					
3					
4					
5					
6					
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Appendix I

Hennecke Body Condition Scoring

Hennecke Body Condition Chart

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EQUINE FACTS

Body Condition Scoring for Your Horse

Bulletin #1010

In a world where millions of people are taking steps to improve their own physical condition in order to live healthier lives, it only stands to reason that this same concept would be applied to other aspects of their lives and businesses. The ability to accurately assess a horse's body condition, which is vital to its welfare, weighs heavily on the horse owner.

The old saying "Beauty is in the eye of the beholder" has never been more appropriate than in the body condition of horses. Beauty in one owner's eye is fat in another's. Hence the problem: What is the appropriate body condition of a horse, and what would be acceptable to the industry? A body conditioning scoring system developed by Dr. Don Henneke has served to provide a standard scoring system for the industry which can be used across breeds and by all horse people. The system assigns a score to a particular body condition (1 to 9) (Table 1) as opposed to vague words such as "good," "fair," "bad," or "poor," which leave differences in interpretation to the eye of the beholder.

The horse's body condition measures the balance between intake and expenditure of energy. Body condition can be affected by a variety of factors such as: food availability, reproductive activities, weather, performance or work activities, parasites, dental problems, and feeding practices. The actual body condition of a horse can also affect its reproductive capability, performance ability, work function, health status, and endocrine status. Therefore, it is important to achieve and maintain proper body condition. In order to do this, one must evaluate body fat in relationship to body musculature. In Maine during winter, a horse's thick hair coat may hide the fact thy are thin. Without extra energy in the winter to stay warm, horses can starve.

Body Condition Scoring System

The system developed by Dr. Henneke assigns a numerical value to fat deposition as it occurs in various places on the horse's body. The system works by assessing fat both visually and by palpation (examination by touch), in each of six areas. Horses accumulate fat in these areas in a set order. For instance, a horse that scores 7 will have the same amount of fat as any other horse that scores 7, whether the horse is a thoroughbred, quarter horse or Arabian.

Fat is assessed in the following areas: the loin, ribs, tailhead, withers, neck, and shoulders (Figure 1). A numerical value is assigned based on the cumulative fat in all six areas (Table 1).

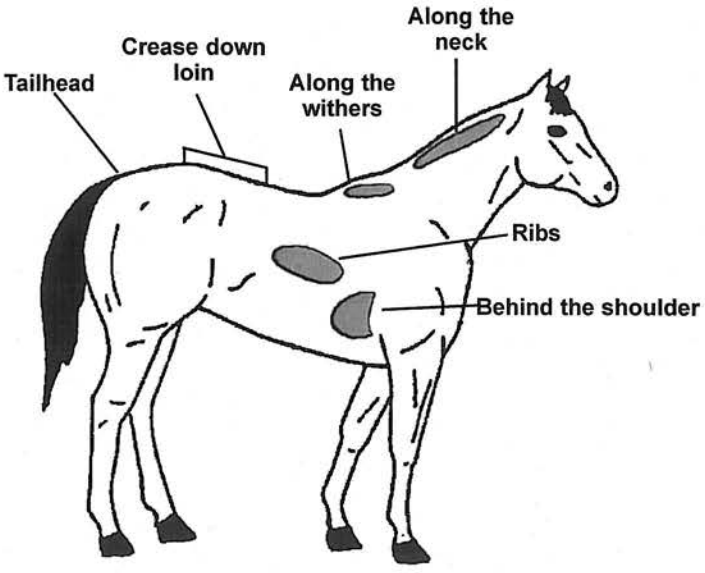


Figure 1

1865 THE UNIVERSITY OF MAINE
Cooperative Extension

Loin: An extremely thin horse will have a negative crease and a ridge down the back where the spinous processes projects up. No fat can be felt along the back of the horse. However, this is one of the first areas to fill in as a horse gains weight. Fat is first laid down around body organs, then along the base of the spinous processes. As the horse gets fatter, an obvious crease or depression forms down the back because of fat accumulation along the spinous processes.

Ribs: The next place to look is in the ribs. Visually assess the rib area, then run your fingers across the rib cage. A very thin horse will have prominent ribs, easily seen and felt, with no fat padding. As the horse begins to gain weight, a little padding can be felt around the ribs; by level 5 the ribs will no longer be visible, but can be easily palpated by passing a hand down the rib cage. Once the horse progresses towards obesity, feeling the ribs will be impossible.

Tailhead: In a very thin horse up to a number 3, the tailhead is prominent and easily discernible. Once the horse starts gaining weight, fat fills in around the tailhead. Fat can easily be palpated, and as the horse becomes obese, the fat will feel soft and begin to bulge.

Withers: Conformation of the withers may affect your assessment of body condition. The prominence or sharpness of the withers may vary between breeds; a thoroughbred typically has more prominent withers than a quarter horse. However, if a horse is very thin, the underlying structure of the withers will be easily visible. At a level 5, the withers will appear rounded. At levels 6 through 8, varying degrees of fat deposits can be felt along the withers. In obese horses, the withers will be bulging with fat.

Neck: The neck allows for refining the assessment of body condition. In an extremely thin horse, you will be able to see the bone structure of the neck, and the throatlatch will be very trim. As the horse gains condition, fat will be deposited down the top of the neck. A body condition score of 8 is characterized by a neck that is thick all around with fat evident at the crest and the throatlatch.

Shoulder: The shoulder will also help you refine the condition score, especially if conformation factors have made some other criteria less helpful. As a horse gains weight, fat is deposited around the shoulder to help it blend smoothly with the body. At increasing condition scores, fat is deposited behind the shoulder, especially in the region behind the elbow.

Putting the System to Work

Once body condition scores have been determined for your horses, how can you tell what is too fat or too thin? It has been suggested that the optimum score is a 5. This horse has some fat but has not yet reached the fleshy point. A horse below a 5 may have fat stores too low to maintain a healthy status if stressed. Body fat reserves are important to the overall health of a horse because fat represents energy reserves that can be used during periods of stress. Horses at a 3 or below have virtually no fat reserves; if more energy is needed, protein is broken down from muscle to meet energy requirements. In addition to increasing the quantity of feed, horse owners should consider checking their horse's teeth, treating for internal parasites and evaluating their horse's health status.

If a horse is exposed to extreme cold, lactation, or some other severe stress, a condition score of 6 or 7 would be desired. A horse can easily burn a great deal of fat in a short period of time in a high stress situation. Body fat also plays a role in reproduction. Mares with a body condition score of 3 or below develop endocrine imbalances and have difficulty conceiving.

Horses with high condition scores are also predisposed to problems, but the problems are less immediate than those of a horse in poor body condition. Fat horses tend to be less agile performers and tire more quickly than trimmer horses. Fat horses are also more prone to colic and laminitis. Extremely fat horses may also have endocrine problems, they may be hypothyroid and show a deficient metabolic rate, which most likely is one reason they are fat.

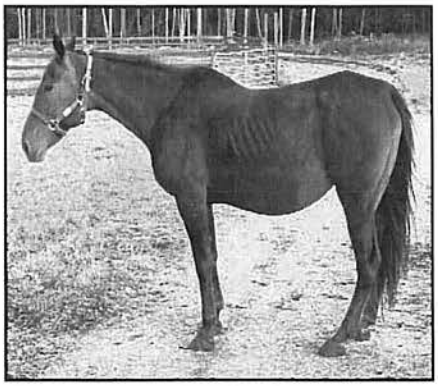
One more factor you should consider when assigning a body condition score is the basic body type of your horse. Some horses, usually the easy keepers, just tend to carry more body fat than others. A horse that always seems to score a 7 or 8, despite attempts to lower the horse's weight, may be perfectly healthy at that score. Additionally, the

horse may require more exercise to keep muscles in shape.

This body condition scoring system will by no means tell you how fit your horse is for performance. Although horses in training will have less fat due to their exercise intensity, the fat level has nothing to do with muscle tone, cardiovascular fitness, or any other measure of athletic conditioning. The scoring system also does not distinguish between types of fat deposited.

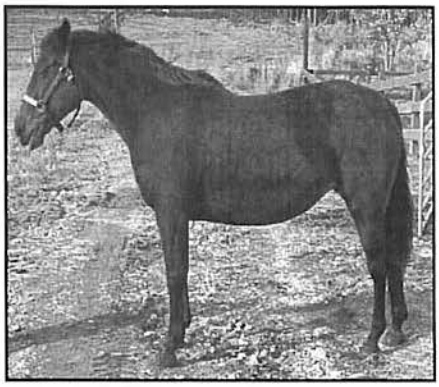
You Make the Call

Determine the body condition of the following three horses based on the system in Table 1.



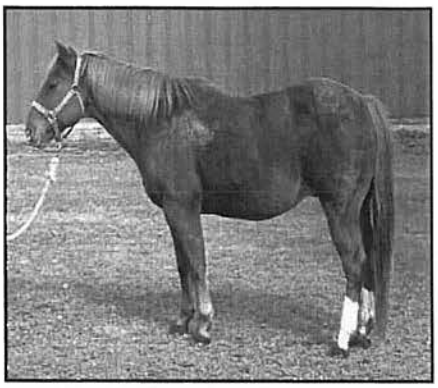
Horse 1

This horse would have a condition score of 3.5. The neck is thin, but not accentuated as required to be a 3. The withers are thin, there is fat buildup halfway on the spinous processes, and the tailhead is prominent but individual vertebrae cannot be visually identified. The ribs are easily discernible with no fat being deposited behind the shoulder.



Horse 2

Horse 2 is a horse that is in proper body condition. His score would be a 5. His neck blends smoothly into his body, the withers are rounded over the spinous processes, and the back is level with no positive or negative crease. Ribs cannot be visually distinguished but can be easily felt and the shoulder blends smoothly into the body.



Horse 3

This horse is obviously fleshy with a condition score of 7. Fat is beginning to be deposited along the top of the neck as well as in and around the withers. This mare is beginning to have a positive crease down her back. The individual ribs are not visible and are becoming increasingly difficult to feel. Fat has been deposited behind the shoulder, but the area behind the shoulder is not yet flush with the body.

Developed by Craig H. Wood, Department of Animal Sciences, College of Agriculture, Cooperative Extension Service, University of Kentucky. Adapted and reprinted with permission.

Published with funding provided by the Maine Farm Bureau Horse Industry Council

Table I. Characteristics of Individual Condition Scores

Condition	Neck	Withers	Loin	Tailhead	Ribs	Shoulder
1 Poor	Bone structure easily noticeable, animal extremely emaciated, no fatty tissue can be felt.	Bone structure easily noticeable.	Spinous processes project prominently.	Spinous processes project prominently.	Tailhead (pinbone) and hook bones project prominently.	Bone structure easily noticeable.
2 Very Thin	Faintly discernable, animal emaciated.	Faintly discernable.	Slight fat covering over base of spinous processes. Transverse processes of lumbar vertebrae feel rounded. Spinous processes are prominent.	Tailhead prominent.	Slight fat cover over ribs. Ribs easily discernable.	Shoulder accentuated.
3 Thin	Neck accentuated.	Withers accentuated.	Fat buildup halfway on spinous processes but easily discernable. Transverse processes cannot be felt.	Tailhead prominent but individual vertebrae cannot be visually identified. Hook bones appear rounded but are still easily discernable. Pin bones not distinguishable.	Slight fat cover over ribs. Ribs easily discernable.	Shoulder accentuated.
4 Moderately Thin	Neck not obviously thin.	Withers not obviously thin.	Negative crease along back.	Prominence depends on conformation; fat can be felt. Hook bones not discernable.	Faint outline discernable.	Shoulder not obviously thin.
5 Moderate	Neck blends smoothly into body.	Withers rounded over spinous processes.	Back level.	Fat around tailhead beginning to feel spongy.	Ribs cannot be visually distinguished but can be easily felt.	Shoulder blends smoothly into body.
6 Moderately Fleshy	Fat beginning to be deposited.	Fat beginning to be deposited.	May have slight positive crease down back.	Fat around tailhead feels soft.	Fat over ribs feels spongy.	Fat beginning to be deposited.
7 Fleshy	Fat deposited along neck.	Fat deposited along withers.	May have positive crease down back.	Fat around tailhead is soft.	Individual ribs can be felt, but noticeable filling between ribs with fat.	Fat deposited behind shoulder.
8 Fat	Noticeable thickening of neck, fat deposited along inner buttocks.	Area along withers filled with fat.	Positive crease down back.	Tailhead fat very soft.	Difficult to feel ribs.	Area behind shoulder filled in flush with body.
9 Extremely Fat	Bulging fat. Fat along inner buttocks may rub together. Flank filled in flush.	Bulging fat.	Obvious positive crease down back.	Building fat around tailhead.	Patchy fat appearing over ribs.	Bulging fat.

From Henneke et al. Equine Vet J. (1983) 15 (4), 371-2.

A Member of the University of Maine System

Published and distributed in furtherance of Acts of Congress of May 8 and June 30, 1914, by the University of Maine Cooperative Extension, the Land Grant University of the state of Maine and the U.S. Department of Agriculture cooperating. Cooperative Extension and other agencies of the U.S.D.A. provide equal opportunities in programs and employment. 12/02

DATE:_____

NAME:_____

FREEZEMARK:_____

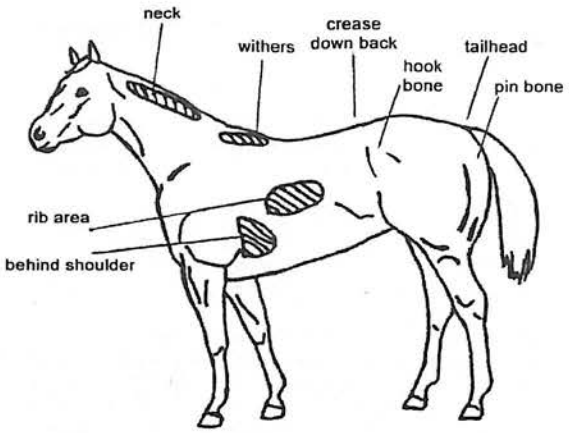
SIGNALMENT KEY:_____

HOOF CONDITION:_____

COMMENTS: _____

_____

OVERALL HENNEKE BODY CONDITION SCORE: [ ]



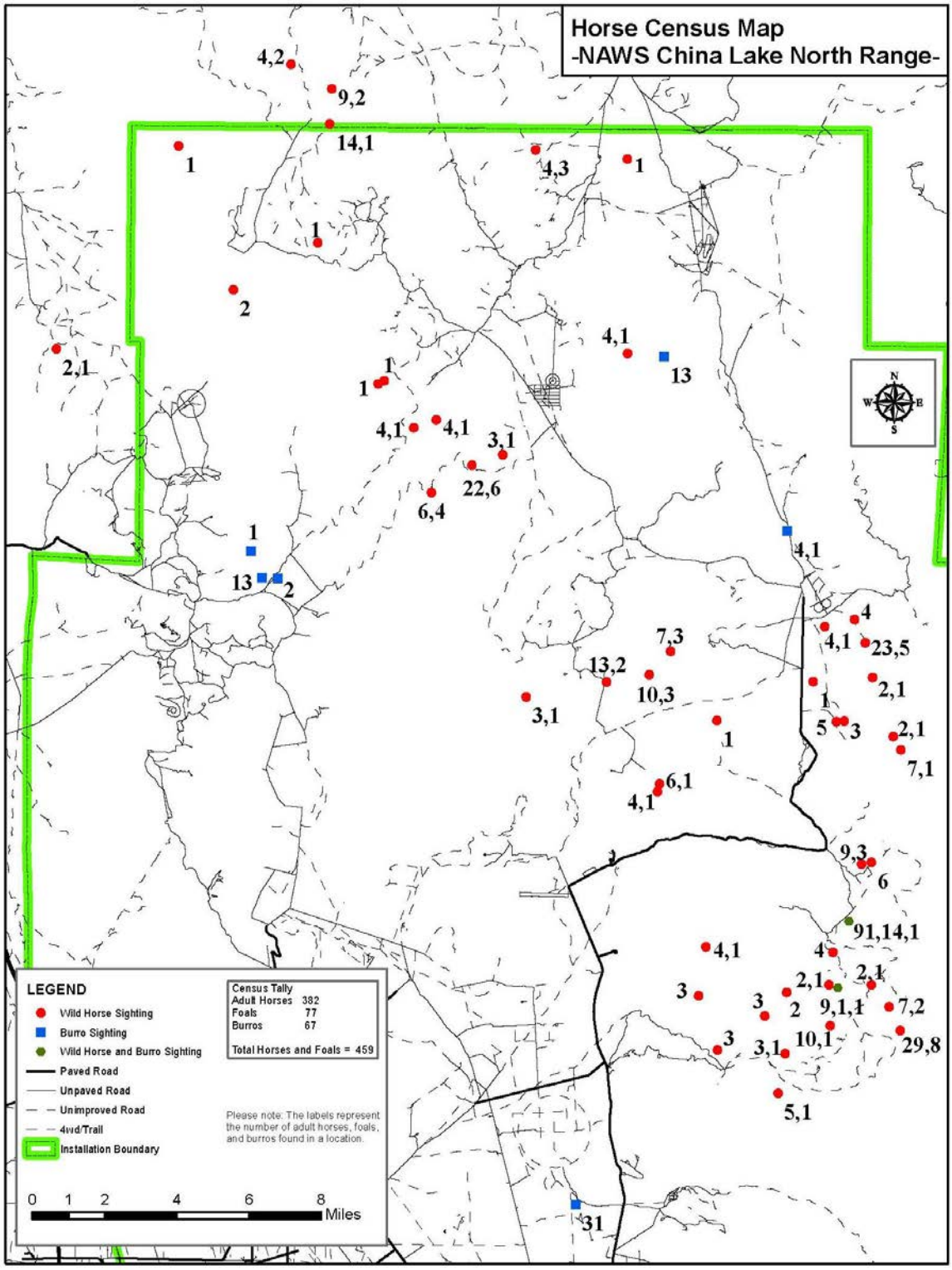
modified from Henneke et al. EVJ 1983;15:371-372

Condition	Neck	Withers	Shoulder	Ribs	Back	Tailhead Area
1 Poor (*extremely emaciated*)	Bone structure easily noticeable	Bone structure easily noticeable	Bone structure easily noticeable	Ribs projecting prominently	Spinous processes projecting prominently	Tailhead, pinbones, and hook bones projecting prominently
	No fatty tissue can be felt					
2 Very Thin (*emaciated*)	Bone structure faintly discernible	Bone structure faintly discernible	Bone structure faintly discernible	Ribs prominent	Slight fat covering over base of spinous processes. Transverse processes of lumbar vertebrae feel rounded. Spinous processes are prominent	Tailhead prominent Pin bones prominent Hook bones prominent
3 Thin	Neck accentuated	Withers accentuated	Shoulder accentuated	Slight fat cover over ribs. Ribs easily discernible	Fat buildup halfway on spinous processes, but easily discernible. Traverse processes cannot be felt	Tailhead prominent but individual vertebrae cannot be visually identified. Hook bones appear rounded, but are still easily discernible. Pin bones not distinguishable
4 Moderately Thin	Neck not obviously thin	Withers not obviously thin	Shoulder not obviously thin	Faint outline of ribs discernible	Negative crease (peaked appearance) along back	Prominence depends on conformation. Fat can be felt. Hook bones not discernible
5 Moderate	Neck blends smoothly into body	Withers rounded over spinous processes	Shoulder blends smoothly into body	Ribs cannot be visually distinguished, but can be easily felt	Back is level	Fat around tailhead beginning to feel spongy
6 Moderately Fleshy	Fat beginning to be deposited	Fat beginning to be deposited	Fat beginning to be deposited behind shoulder	Fat over ribs feels spongy	May have a slight positive crease (a groove) down back	Fat around tailhead feels soft
7 Fleshy	Fat deposited along neck	Fat deposited along withers	Fat deposited behind shoulder	Individual ribs can be felt, but noticeable fat filling between ribs	May have a positive crease down the back	Fat around tailhead is soft
8 Fat	Noticeable thickening of neck	Area along withers filled with fat	Area behind shoulder filled with fat	Difficult to feel ribs	Positive crease down the back	Fat around tailhead very soft
9 Extremely Fat	Bulging fat	Bulging fat	Bulging fat	Patchy fat appearing over ribs	Obvious crease down the back Flank filled with fat	Bulging fat around tailhead

Henneke Equine Body Scoring Chart 1_18_07.xls

Appendix J

NAWS China Lake North Range
Horse Census Map


Horse Census Map
-NAWS China Lake North Range-
LEGEND
Wild Horse Sighting
Burro Sighting
Wild Horse and Burro Sighting
Paved Road
Unpaved Road
Unimproved Road
4wd/Trail
Installation Boundary
Census Tally
Adult Horses 382
Foals 77
Burros 67
Total Horses and Foals = 459
Please note: The labels represent the number of adult horses, foals, and burros found in a location.
0 1 2 4 6 8 Miles
N
W
E
S

Appendix N: Implementation Summary Table for the NAWS-CL INRMP

Table N-1. Integrated Natural Resources Management Plan Implementation Summary, including the assignment of priorities based on the legal driver behind each project.

EPR Number	INRMP Section	Class Level	Objective/Project or Activity	Legal Driver	Implementation Year			Measure of Success or Desired Future Condition
					Recurring	2013-2018	2019-2024	
	1.8.1 Ecosystem Management	3	Implement a coordinated monitoring program using land health and focal species indicators that can: – be implemented cost-effectively over time; – facilitate reporting on natural resources condition in relation to other Mojave Desert areas; and – answer annual INRMP program metrics questions. – Set habitat objectives based on ecological sites, ecosystem function indicators, and the requirements of focus species and that can be scaled up to the work of other agencies. Map subregions for natural resources management, data summary, effects analysis, and reporting. Subregions should be based on areas with relatively uniform military use and/or ecological subregions.	Sikes Act, EO 13186, EO 13112, DoD guidance on ecosystem approach; DoD Interagency MOU on federal data standards; Navy guidance on annual INRMP program metrics.	Recurring			Implement ecosystem integrity measures. Continue to facilitate effective partnerships among private, local, state, tribal, and federal interests. Maintain disturbance regimes, hydrological processes, and nutrient cycles, to the extent practicable. Manage and monitor resources over sufficiently long time periods to allow for adaptive management and assessment.
689371236D 689371235C 689371235A	3.3.4 Water Resources, Water Quality, Sediment Quality	4	Develop an integrated spring monitoring, enhancement, and adaptive management plan. Update and collect additional baseline data, such as water chemistry, flow rates, aerial extent, vegetation and other parameters.	ESA, EOs, Migratory Birds, Invasive Species requirements				Biologically or geographically significant or sensitive natural resources are monitored and managed for long-term sustainability. Policy, procedures, and program objectives are prioritized to prevent listing and minimize impacts to military readiness.
	3.3.4.3 Floodplains and Flooding	2	Assist Navy planners in creating a flood hazard boundary map so that the severity and type of flooding may be predicted, and impacts to floodplains may be avoided. Identify any special or unique flora and fauna associated with floodplains in order to identify the natural and beneficial functions provided by floodplains.	EO 11988				Floodplains are mapped and impacts to them are, therefore, avoided and minimized as practicable.

EPR Number	INRMP Section	Class Level	Objective/Project or Activity	Legal Driver	Implementation Year			Measure of Success or Desired Future Condition
					Recurring	2013-2018	2019-2024	
	3.3.5 Jurisdictional Waters of the U.S.	3	Continue to assess the applicability of Section 404 of the CWA as it may apply to the jurisdictional status of all water features on NAWS-CL.	CWA				Complete a review of applicable regulations. Develop maps of impact areas that may require avoidance and minimization measures, if required.
689371236D 689371235C 689371235A 6893720127 68937B0109	3.5 Plant, Fish and Wildlife Populations	4	Continue to conduct baseline inventories and develop maps of high value habitats of to management focus species. Continue resource avoidance, minimization, and conservation measures, and reduce potential of conflict with the military mission.	Sikes Act, DoD Partnership				Ensure that best available scientific information is used in decision-making and adaptive management techniques for natural resource management. Biologically or geographically significant or sensitive natural resources are monitored and managed for long-term sustainability.
68937B0109	3.5 Plant, Fish and Wildlife Populations	4	Continue to encourage research partnerships with other agencies, organizations, and researchers to refine baseline data on the plants and animals at NAWS-CL.	Sikes Act, DoD Partnership				Ensure that best available scientific information is used in decision-making and adaptive management techniques for natural resource management.
68937B0109	3.5.2 Special Status Plant Species	4	Continue to conduct rare plant inventories priority/likely areas. Prioritize searches based on habitat suitability, threats and vulnerabilities, potential for locating endemics, and under-represented areas, as practicable.	Sikes Act, ESA				Biologically or geographically significant or sensitive natural resources are monitored and managed for long-term sustainability. Policy, procedures, and program objectives for the management of NAWS-CL Special Status Species and SAR are prioritized to prevent listing and minimize impacts to military readiness.
	4.3 Soil Resources	3	Continue to implement the best management practices and comply with local and federal agency dust control measures. Support the development of a Wind and Water Erosion Best Practice Manual.	Sikes Act, CAA, CWA				Fugitive dust control measures and implemented in compliance with local and federal requirement Soil conservation is implemented as required. Ecosystem integrity is maintained in direct support of the military mission.

EPR Number	INRMP Section	Class Level	Objective/Project or Activity	Legal Driver	Implementation Year			Measure of Success or Desired Future Condition
					Recurring	2013-2018	2019-2024	
	4.3 Soil Resources	3		Consider the long-term development of a GIS layer of ecological sites and land management units incorporating soil data points and field assessments based on federal standards.	Sikes Act, EO 13186, EO 13112, DoD guidance on ecosystem approach. DoD Interagency MOU on federal data standards.			INRMP metrics may be compared to other installations. Reasonably non-recoverable soil impacts are avoided or minimized. Compliance with applicable soil conservation requirements is maintained.
	4.4 Wildland Fire Management	3	Continue to work with Station and regional fire officials to identify high-value resource areas, assess fire danger, track fire patterns, and assist with maintenance of mutual support agreements. Assess burn area recovery and the need for rehabilitation in these areas as practicable. Assist with the development and implementation of a wildland fire response plan.	Sikes Act, MBTA-Migratory Bird Rule, CDPA, DoDI 6055.6, EO 13514				Restore or rehabilitate altered or degraded landscapes and associated habitats. Promote ecosystem and land sustainability, when practicable and in concert with mission requirements. Natural resources are monitored and managed for their long-term sustainability. Policy, procedures, and program objectives for the management of NAWS-CL Special Status Species and SAR are prioritized to prevent listing and minimize impacts to military readiness.
689371236D	4.5 Vegetation and Habitats	4	Improve the classification of vegetation alliances over time, based on standards adopted by Federal Geographic Data Committee and used by the Mojave Desert Ecosystem Program (Thomas et al. 2004), and already implemented in 1996-1997 at NAWS-CL (Silverman 1997).	Interagency MOU on federal geospatial standards, Sikes Act				Biologically or geographically significant or sensitive natural resources are identified, monitored and managed for long-term sustainability. High risk resources are prioritized to prevent listing and minimize impacts to military readiness.

EPR Number	INRMP Section	Class Level	Objective/Project or Activity	Legal Driver	Implementation Year			Measure of Success or Desired Future Condition
					Recurring	2013-2018	2019-2024	
689371236D	4.5 Vegetation and Habitats	4	Update the Range Assessment Program to answer more specific questions about grazing impacts, land health, and recovery from disturbance. Expand work to include additional key habitats. Consider restoring perennial grasses and perennial forbs appropriate for sites to enhance site stability and wildlife habitat, and that are likely to have been impacted by grazing, as practicable.	Sikes Act, ESA, EO 13186, 13514				Restore or rehabilitate altered or degraded landscapes as practicable. Promote native ecosystems and land sustainability as practicable. Ensure these practices do not conflict with military mission or capabilities. High risk resources are prioritized to prevent listing and minimize impacts to military readiness.
689371236D 68937B0102 689371236E 689371235A 6893720125	4.5 Vegetation and Habitats	4	Develop a long-term program for riparian, wetland, seep, and spring protection, restoration and enhancement. Reduce burro and horse numbers as necessary to avoid or minimize detrimental effects on riparian and other sensitive habitats for wildlife. Consistent with the CDPA Plan, support restoration of unusual plant assemblages including areas classified as wetland riparian.	CDPA, Sikes Act, EO 11990, EO 13186, California Wildlife Action Plan, DoD MOU on Ecosystem Approach (partnerships)				Biologically or geographically significant or sensitive natural resources are monitored and managed for long-term sustainability. High risk resources are prioritized to prevent listing and minimize impacts to military readiness. Continue implementation of programs to protect high value habitats, sensitive and protected species.
68937B0105	4.6.1 Critical Habitat Designation	4	Continue to survey and assess all unoccupied but suitable habitat for the Inyo California towhee.	ESA, NDRA 2004				Contribute to protection and recovery of listed species. Continue long-term monitoring efforts.
68937B0109	4.6.1 Critical Habitat Designation	4	Monitor condition of habitat that supports, or could support, the three listed species and Lane Mountain milk-vetch through a habitat assessment program.	ESA, Sikes Act				Contribute to protection and recovery of listed species. High risk resources are prioritized to prevent listing and minimize impacts to military readiness.
689371235A 6893701211 68937B0101	4.7.3 Invasive Species	4	Continue to monitor for invasive species, document status and new occurrences. Continue control efforts and monitor effectiveness of removal efforts.	ESA, Sikes Act, EO 13112				Identify new occurrences, treat, and monitor control effectiveness over time. Maintain/increase funding levels to adequately address invasive species threats.

EPR Number	INRMP Section	Class Level	Objective/Project or Activity	Legal Driver	Implementation Year			Measure of Success or Desired Future Condition
					Recurring	2013-2018	2019-2024	
	4.7.4 Invertebrates	2	Continue to support invertebrate studies through cooperative agreements, contracts and other means.	Sikes Act				Biologically or geographically significant or sensitive species are monitored and managed for long-term sustainability. High risk species and habitats are prioritized to prevent listing and minimize impacts to military readiness.
	4.7.5 Amphibians and Reptiles	3	Consider using the California Gap Analysis Program (CA-GAP) as a model.	Sikes Act, PARC				Significant or sensitive amphibians and reptiles are monitored and managed for long-term sustainability. High risk species are prioritized to prevent listing and minimize impacts to military readiness.
	4.7.5 Amphibians and Reptiles		Conduct surveys to determine the status and distribution of chuckwalla, Panamint alligator lizard, Gilbert's skink, red spotted toad, slender salamander, and other NAWS-CL Special Status reptiles and amphibians.	Sikes Act, PARC				Continue to conduct surveys and implement monitoring and management techniques for biologically or geographically significant or sensitive species. To the extent practicable ensure long-term sustainability of species and habitats. High risk species are prioritized to prevent listing and minimize impacts to military readiness.
	4.7.5 Amphibians and Reptiles	3	Extirpate non-native amphibians from water sources, such as bullfrogs from the North channel of Lark Seep.	NAIS, Sikes Act, PARC				Implement bullfrog and other invasive species control procedures.
	4.7.5 Amphibians and Reptiles	3	Participate in DoD Partnership on Herptile Conservation (DoD PARC).	Sikes Act, PARC				Actively participate in DoD PARC. High risk species are prioritized to prevent listing and minimize impacts to military readiness.

EPR Number	INRMP Section	Class Level	Objective/Project or Activity	Legal Driver	Implementation Year			Measure of Success or Desired Future Condition
					Recurring	2013-2018	2019-2024	
6893720127	4.7.6 Birds	4	Establish a program ~~to implement the DoD Readiness Waiver to the MBTA~~that tracks the implementation of the MBTA Readiness Waiver. Establish a monitoring program to assess baseline bird population levels to facilitate the assessment of effects of range testing operations. Implement annual reporting of migratory bird impacts from range operations if necessary Continue to develop and refine surveying techniques and minimization and mitigation measures.	MBTA-Migratory Bird Rule				Implement procedural provisions to support application of the Readiness Waiver to the MBTA. Conduct bird surveys in target areas and in representative habitat types to assess impacts to bird species at a population level. Design impact avoidance and mitigations measures to minimize impacts to affected species. Conduct efforts in concert with NAWC-WD to support compliance and mission accomplishment.
6893720127	4.7.6 Birds	4	Continue to develop and enhance baseline data on presence, activity, and use areas for migratory birds. Incorporate monitoring and reporting requirements from the Raven MOU if applicable.	Sikes Act, MBTA, EO 13186, MBTA-Migratory Bird Rule				Assess impacts to MBTA protected species. Manage resources to facilitate for long-term sustainability. High risk species are prioritized to prevent listing and minimize impacts to military readiness.
	4.7.6 Birds	3	Develop a habitat protection, enhancement and management program for management focus species building on habitat value and use area maps for birds. Consider enhanced management efforts at the wastewater treatment ponds.	MBTA-Migratory Bird Rule, EO 13186				High risk species are prioritized to prevent listing and minimize impacts to military readiness. Prioritize policies, procedures, and program objectives for the management of species to prevent listing and protect species to minimize impacts military readiness.
68937B0102 689371236E 68937B0105	4.7.6 Birds	4	Continue to implement the NAWS-USFWS Inyo California towhee MOA intended to facilitate delisting of this species.	ESA				Ensure compliance with provisions of the existing BO and fully implement management actions required by the MOA. Monitor population status to contribute to the eventual de-listing of this species and support mission accomplishment.

EPR Number	INRMP Section	Class Level	Objective/Project or Activity	Legal Driver	Implementation Year			Measure of Success or Desired Future Condition
					Recurring	2013-2018	2019-2024	
	4.7.6 Birds	2	Continue to work with other wildlife management agencies on bird census, survey, trapping, banding, and translocation efforts.	Sikes Act, EO 13186				Biologically or geographically significant or sensitive natural resources are monitored and managed for long-term sustainability. Research efforts are supported to the extent practicable.
	4.7.7 Mammals	3	Conduct genetic and taxonomic studies on the vole and shrew populations. Consider conducting additional surveys to determine the range of these animals.	Sikes Act				Species distributions are better defined and taxonomic studies continue to be supported. Known and potential habitats continue to be protected to extent practicable and managed for their long-term sustainability. Data is provided to and research coordinated with regional land managers to facilitate range-wide management and to prevent listing and minimize impacts to military readiness.
	4.7.7 Mammals	3	Consider installation of bat gates at mines utilized as roost or maternity colonies of Townsend's big-eared bats, including Redwing mine, lower Star of the West mine, and Josephine mine.	Sikes Act				Biologically or geographically significant or sensitive bat species are monitored and managed for long-term sustainability. Data is provided to and research coordinated with regional land managers to facilitate range-wide management and to prevent listing and minimize impacts to military readiness.
68937B0126	4.7.7 Mammals	4	Continue to monitor the status of bighorn sheep and other NAWS-CL Special Status Species.	Sikes Act, NPS Cooperative Agreement				Bighorn sheep are monitored and managed for long-term sustainability. Data is provided to and research coordinated with regional land managers to facilitate range-wide management and to prevent listing and minimize impacts to military readiness.

EPR Number	INRMP Section	Class Level	Objective/Project or Activity	Legal Driver	Implementation Year			Measure of Success or Desired Future Condition
					Recurring	2013-2018	2019-2024	
	4.7.7 Mammals	3	Conduct additional mammal surveys and assessments as needed. Continue to support research requests from outside agencies and organizations.	Sikes Act				Species distributions are better defined and taxonomic studies continue to be supported. Known and potential habitats continue to be protected to extent practicable and managed for their long-term sustainability. Data is provided to and research coordinated with regional land managers to facilitate range-wide management and to prevent listing and minimize impacts to military readiness.
68937B0102 6893720121	4.7.7.1 Wild Horses and Burros	4	Continue implementation of wild horse and burro management efforts. Implement enhanced management techniques defined in the INRMP.	ESA				Horse and burro numbers are maintained at AML.
68937B0096	4.8.1.1 Mohave Tui Chub	4	Continue to maintain and enhance habitat. Plant non-invasive species, such as bulrush, in Mohave tui chub habitat to prevent cattail reinvasion. Continue water quality monitoring efforts	ESA				Chub habitat remains in a properly managed condition. Invasive species are controlled and water quality standards are maintained.
68937B0096	4.8.1.1 Mohave Tui Chub	4	Continue mark-recapture studies to examine population dynamics and distribution.	ESA				Ensure population levels continue to be assessed and that numbers remain within reasonable levels.
68937B0096	4.8.1.1 Mohave Tui Chub	4	Continue to work with CDFW, USFWS, and other organizations to facilitate establishment of populations in other refugia.	ESA				Efforts to establish other populations and refugia are actively supported. Efforts designed to eventually delist this species are actively supported.
6893718537	4.8.1.2 Desert Tortoise	4	Continue monitoring of desert tortoise abundance, distribution and trends. Implement surveys, avoidance, impact minimization measures and other elements of the current BO.	ESA, Sikes Act				Compliance with provisions of the current BO is maintained.
	4.8.1.2 Desert Tortoise	2	Continue to support monitoring and research on desert tortoise by outside agencies.					Continue to support ongoing research and survey efforts by outside agencies and organizations. Support species recovery efforts to the extent practicable.

EPR Number	INRMP Section	Class Level	Objective/Project or Activity	Legal Driver	Implementation Year			Measure of Success or Desired Future Condition
					Recurring	2013-2018	2019-2024	
68937B0105	4.8.1.3 Inyo California Towhee	4	Continue to conduct surveys and population assessments in the known range of the towhee. Continue to investigate other potential locations in the North Range for possible use by towhees.	ESA, DoD Partnership				Compliance with BO and contributions to recovery and de-listing of species is maintained
68937B0102 689371236E	4.8.1.3 Inyo California Towhee	4	Continue habitat protection and enhancements, such as controlling horse and burro numbers and access to riparian areas. Control invasive plants. Consider initiating habitat recovery monitoring in habitat impacted by wildfires.	ESA, EO 13186				Provisions of MOA with USFWS are implemented.
	4.8.1.4 Mohave Ground Squirrel	3	Continue to support ongoing efforts to study and monitor the Mohave ground squirrel.	Sikes Act, DoDI 4715.03				Conservation of state-listed species is implemented as practicable, and does not conflict with legal authority, the military mission, or operational capabilities. Policy, procedures, and program objectives for the management of state-listed species are prioritized to prevent listing and minimize impacts to military readiness.
	5.2 Adapting to Regional Growth and Climate Change	1	Monitor emerging research and assess potential implications to NAWS-CL.	Sikes Act, DoDI 4715.03				Consider the effects of climate change to natural resources. Implement management changes as appropriate.
	5.3 Animal Damage Control	2	Comply with the MBTA and obtain depredation permits for control of bird problems as warranted. Consider expanding the permits to cover other installation facilities.	MBTA				Safe and efficient procedures for preventing and controlling animal pests that affect human health and safety and to avoid negative impacts to native wildlife and habitats are implemented Compliance with USFWS depredation permit (50 CFR 21.41) is maintained.
	5.3.1 Bird/Wildlife Aircraft Strike Hazard Prevention	3	Support BASH Program in concert with Airfield Operations. Implement recommendations from the avian use survey as appropriate.	Navy Mission, Sikes Act, NAWSINST 3750.2				Bird hazards are controlled, reducing bird/wildlife aircraft strike hazards.
	5.3.1 Bird/Wildlife Aircraft Strike Hazard Prevention	2	Continue to share data with the Los Angeles Department of Water and Power (LADWP) Owens Lake Re-watering program. Monitor high seasonal bird use areas as needed.	Navy Mission, Sikes Act, NAWSINST 3750.2				Bird/wildlife aircraft strike hazards are reduced.

EPR Number	INRMP Section	Class Level	Objective/Project or Activity	Legal Driver	Implementation Year			Measure of Success or Desired Future Condition
					Recurring	2013-2018	2019-2024	
	5.3.1 Bird/Wildlife Aircraft Strike Hazard Prevention	2	Perform more focused avian surveys at sites deemed to be the most hazardous to aircraft operations.	Navy Mission, Sikes Act, NAWSINST 3750.2				Bird/wildlife aircraft strike hazards are reduced.
	5.5.1 Game Hunting	2	Contribute to a public website to explain public access opportunities and events in collaboration with the Cultural Resources program, MWR, and Public Relations personnel. Prepare a recreational plan with MWR for installation personnel and/or the public.	Sikes Act				DoD installations remain available to the public for hunting when not in conflict with mission or environmental goals. Compliance with chukar EA is maintained.
	5.5.2 Public Access and Outreach	2	Support public access opportunities and events, in collaboration with the Cultural Resources program, MWR, and Public Relations personnel.	Sikes Act, EO 13186, MOUs on migratory birds, Watchable Wildlife, pollinators, bat conservation, PARC, etc.				Opportunities for public access are equitably and impartially allocated, military mission impacts are avoided and safety, security and environmental issues are resolved.
	5.6 Landscaping and Grounds	2	Assist with development of an updated Landscaping Plan and Instruction consistent with applicable guidance.	EO 13123, EO 13112, Presidential Memorandum				Water resources are conserved, pesticide use reduced, and cost savings are realized by use of native and regionally adapted plants. Landscaping conforms to Base Exterior Architectural Plan, used to moderate solar heat gain, glare, dust, and wind, conserve energy, protect water quality, facilitate soil conservation, and buffer noise.
	5.7 Beneficial Partnerships and Collaborative Planning	2	Support DoD MOUs such as PARC, pollinators, migratory birds, National Biological Information Infrastructure.	Sikes Act				Partnerships and funding are improved.
	5.12.1 Cataloging and Reporting Natural Resources Information	3	Continue to digitally archive all research data and reports. Update at least every five years.	Sikes Act, OMB, DoD guidance on ecosystem approach, Navy guidance on annual INRMP program metrics.	Every 5 years			Available information is readily available to support decision-making and adaptive management. Data is collected in accordance with OMB guidelines.

EPR Number	INRMP Section	Class Level	Objective/Project or Activity	Legal Driver	Implementation Year			Measure of Success or Desired Future Condition
					Recurring	2013-2018	2019-2024	
	5.13 Training of Natural Resources Personnel	2	Ensure environmental staff receives ongoing training and professional development through attendance at workshops, classes, training, and conferences.	Sikes Act, Navy guidance on INRMP program	Annually			Necessary supplemental training to ensure the proper and efficient management of those resources is provided in a timely manner.

Appendix O: Reporting on Benefits for Endangered Species and Critical Habitat Concerns

The objective of this Appendix is to identify the management and conservation efforts that would be considered when designating critical habitat under the Endangered Species Act (ESA) for Naval Air Weapons Station China Lake (NAWS-CL).

Critical Habitat Designation and Exemption Based on the INRMP

Under the ESA, the term "critical habitat" is defined as specific areas within the species range at the time of listing that contain features, both physical and biological, that are essential to the conservation of the species. These areas may require special management or protection considerations. Critical habitat also includes specific areas of known unoccupied habitat outside of the species geographical range at the time of listing that may be essential for the conservation of the species as determined by the Secretary of the Interior.

Concurrent with a determination to list a species as threatened or endangered, the Secretary of Interior is required to designate critical habitat for the species. However, the ESA was revised via the National Defense Authorization Act of 2004 (Public Law 108-136) to recognize Integrated Natural Resources Management Plan (INRMP) conservation measures and species benefit that could obviate the need for critical habitat designation on U.S. Department of the Navy (Navy) lands. Section 4(a)(3) of the revised ESA states that:

> The Secretary [of the Interior] shall not designate as critical habitat any lands or other geographical areas owned or controlled by the Department of Defense, or designated for its use, that are subject to an integrated natural resources management plan prepared under section 670a of this title (section 101 of the Sikes Act [as amended]), if the Secretary determines in writing that such plan provides a benefit to the species for which critical habitat is proposed for designation.

All Navy installations with federally listed threatened or endangered species, proposed federally listed threatened or endangered species, candidate species, or unoccupied habitat for a listed species where critical habitat may be designated, must structure the INRMP to avoid the designation of critical habitat. The INRMP may obviate the need for critical habitat if it specifically addresses both the benefit provided to the listed species and the provisions made for the long-term conservation of the species. The species benefit must be clearly identifiable in the document and should be referenced as a specific topic in the INRMP table of contents.

The U.S. Fish and Wildlife Service (USFWS) utilizes a three-point criteria test, to determine if an INRMP provides a benefit to the species. An installation is strongly encouraged to use these USFWS criteria, listed below, when structuring its INRMP to avoid the need for critical habitat designation.

1. The plan provides a conservation benefit to the species. The cumulative benefits of the management activities identified in a management plan must maintain or provide for an increase in a species' population, or the

enhancement or restoration of its habitat within the area covered by the plan [i.e. those areas deemed essential to the conservation of the species] for the duration of the plan. A conservation benefit may result from reducing fragmentation of habitat, maintaining or increasing populations, insuring against catastrophic events, enhancing and restoring habitats, buffering protected areas, or testing and implementing new conservation strategies.

2. The plan provides certainty that the management plan will be implemented. Persons charged with plan implementation are capable of accomplishing the objectives of the management plan and have adequate funding for the management plan. They have the authority to implement the plan and have obtained all the necessary authorizations or approvals. An implementation schedule, including completion dates, for the conservation effort is provided in the plan.
3. The plan provides reasonable certainty that the conservation effort will be effective. The following criteria will be considered when determining the effectiveness of the conservation effort. The plan includes: 1) biological goals (broad guiding principles for the program) and objectives (measurable targets for achieving the goals); 2) quantifiable, scientifically valid parameters that will demonstrate achievement of objectives and standards for these parameters by which progress will be measured are identified; 3) provisions for monitoring and, where appropriate, adaptive management; 4) provisions for reporting progress on implementation (based on compliance with the implementation schedule) and effectiveness (based on evaluation of quantifiable parameters) of the conservation effort are provided; and 5) a duration sufficient to implement the plan and achieve the benefits of its goals and objectives.

Management for long-term conservation of the species involves both occupied and unoccupied habitat. For occupied habitat, the installation first determines whether the area contains the physical and biological features essential to the conservation of the species and whether this area has or needs special management or protection. Additional special management is not required if adequate management or protection is already in place.

Land management of unoccupied habitat areas should also be addressed in the INRMP, even if the listed species that could potentially occupy that habitat are not present on the installation. This will help to prevent the designation of critical habitat for species that could occur or historically occurred on the installation but are not currently present. Special management is not required if adequate management or protection is already in place.

The National Defense Authorization Act of 2004 (Public Law 108-136) further revised the ESA, via Section 4(b)(2), to preclude critical habitat designation based on impacts to national security.

Section 4(b)(2) of the revised ESA states that:

> The Secretary shall designate critical habitat, and make revisions, thereto, under subsection (a)(3) of this section on the basis of the best scientific data available and after taking into consideration the economic impact, the impact on national security, and any other relevant impact, of specifying any particular area as critical habitat. The Secretary may exclude any area from critical habitat if he determines that the benefits of such exclusion outweigh the benefits of specifying such area as part of the critical habitat, unless he determines, based on the best scientific and commercial data available, that the failure to designate such area as critical habitat will result in the extinction of the species concerned.

O.1 Mohave Tui Chub (*Siphateles bicolor mohavensis*): Endangered

Related Sections

3.5.8.1 Mohave Tui Chub

Management Strategy for Mohave Tui Chub

Project Summary	Legal Driver
Continue to maintain and enhance habitat. Plant non-invasive species, such as bulrush, in Mojave tui chub habitat to prevent cattail reinvasion. Continue water quality monitoring.	ESA
Continue mark-recapture studies to examine population dynamics and distribution.	ESA
Continue to work with CDFW, USFWS, and other organizations to facilitate establishment of populations in other refugia.	ESA

O.1.1 Benefits Derived from Management Actions Proposed in the INRMP

I. Development of diverse pond and channel characteristics to provide suitable habitat for Mohave tui chub production.

II. Comprehensive and updated Geographic Information System database of Mohave tui chub occurrences for resources management.

III. Development of an emergency plan to be implement if the survival of the chub population is threatened.

IV. Development of a plan for habitat improvement leading to a low-maintenance wetland system, which will provide a more stable environment for the chub.

O.1.2 Schedule of INRMP Implementation

The schedule for the implementation of the INRMP with completion dates for projects will be shown in Chapter 6.

O.1.3 Effectiveness of INRMP

(1) Biological Goals

The primary biological goal is maintaining a viable population of Mohave tui chub on NAWS-CL. This fundamental goal is made practical by successfully implementing plans that protect, and in some cases enhance, the existing habitat and water resources on NAWS-CL. Measures to achieve this outcome include (but are not limited to):

I. Routinely excavating cattails.

II. Frequently removing non-native bullfrog infestations.

Guiding principles and measurable targets to determine whether goals are being reached need to be devised.

(2) Progress Achievement Standards

In order to ensure that the Mohave tui chub population on NAWS-CL is benefitting from the proposed efforts, standard methods to assess progress will be applied. This assessment could be accomplished by evaluating populations and habitats including (but not limited to):

I. Conducting chub population censuses, ideally annually, but not less than every three years, with confirmation of chub presence at regular intervals between major census efforts.

Scientific standard parameters to demonstrate objectives are met successfully need to be identified.

(3) Monitoring and Adaptive Management

Maintaining a healthy population of Mohave tui chub on NAWS-CL inherently involves consistent monitoring and an adaptive management approach that exploits successes and modifies unsatisfactory practices. This task can be accomplished by employing various monitoring efforts and reviewing the populations' response to ongoing management activities. Efforts include (but are not limited to):

I. Maintaining and improving the Mohave tui chub habitat in the Lark Seep System.

- **A.** Continuing long-term habitat monitoring by regularly testing water quality of the Lark Seep system within the channels including dissolved oxygen, pH, temperature, toxics, flow rates, and other parameters.
- **B.** Maintaining the water distribution through the channels which includes widening and deepening portions of the channels to create more preferred deep-water habitat for the chub.

II. Conducting research to identify factors to ensure successful transplants into other aquatic systems with the goal of recovery and eventual delisting of the species.

(4) Reporting

The reporting associated with the efforts targeted towards Mohave tui chub recovery will be based on the level of evaluation and the extent of the effort as well as compliance with the implementation schedule.

(5) Projected Effort

Generally speaking, the period of performance is dependent on the time required to achieve the benefits, goals, and objectives of the management plan.

O.2 Desert Tortoise (*Gopherus agassizii*): Threatened

Related Sections

3.5.5 Reptiles and Amphibians
3.5.8.2 Mohave Desert Tortoise

Management Strategy for Desert Tortoise

Project Summary	Legal Driver
Continue to monitor desert tortoise abundance and trend, avoidance and minimization measures in the DTHMA, and other elements of the 1995 Biological Opinion (BO).	ESA, Sikes Act
Periodically evaluate range operations and potential impacts to ensure compliance and applicability of the current BO.	ESA

Continue to support monitoring and research on desert tortoise by outside agencies.	ESA

O.2.1 Benefits Derived from Management Actions Proposed in the INRMP

Among the benefits attributed to the execution of the INRMP, there are many that promote the desert tortoise. Some of the benefits include:

I. Develop a computer database that would provide data for an annual report, locations of incidental sightings, general locations, and size and results of surveys.

II. Maintain habitat quality and integrity. Continue to implement procedures designed to minimize adverse effects of wildland fires.

III. Maintain corridors to adjacent populations (to allow genetic flow) by avoiding habitat fragmenting construction activities or operations whenever possible.

IV. Maintain habitat quality and integrity. Continue to implement procedures designed to minimize adverse effects of wildland fires.

O.2.2 Schedule of INRMP Implementation

The schedule for the implementation of the management plan with completion dates for projects will be shown in Chapter 6.

O.2.3 Effectiveness of INRMP

(1) Biological Goals

The primary goal for the desert tortoise is to maintain a viable population of desert tortoises on NAWS-CL through compliance with the Biological Opinion (BO) of 1995.

Guiding principles and measurable targets to determine whether goals are being reached need to be devised.

(2) Progress Achievement Standards

Continue surveys to refine knowledge and monitor tortoise distribution, density, and population health at NAWS-CL.

Scientific standard parameters to demonstrate objectives are met successfully need to be identified.

(3) Monitoring and Adaptive Management

I. Continue monitoring of desert tortoise abundance and trend, avoidance and minimizations measures in the Desert Tortoise Habitat Management Area (DTHMA), and all other elements of the 1995 BO.

II. Consider establishment of at least two long-term trend study plots (or hectare plots) to look at fertility, fecundity, and other demographic parameters.

III. Periodically evaluate range operations and potential impacts to ensure compliance and applicability of the existing BO.

(4) Reporting

As directed by the BO for desert tortoise at NAWS-CL, an annual report is submitted to USFWS with information on all surveys of new projects completed by NAWS-CL and the resultant impacts to desert tortoise.

The reporting associated with the efforts targeted towards desert tortoise recovery will be based on the level of evaluation and the extent of the effort as well as compliance with the implementation schedule.

(5) Projected Effort

Generally speaking, the period of performance is dependent on the time required to achieve the benefits, goals, and objectives of the management plan.

Raven Environmental Assessment Compliance

In addition to the objectives of the management plan for the desert tortoise, the negative impact from raven predation is addressed under a specific Environmental Assessment. The manner in which this issue is managed is as follows:

A. Comply with the ESA and Migratory Bird Treaty Act with regard to take of migratory birds that are predators of the federally threatened desert tortoise.

1. Ravens will be managed in a manner to protect the desert tortoise (ESA, National Environmental Policy Act, Migratory Bird Treaty Act). NAWS-CL will operate in compliance with the Raven Management Memorandum of Understanding and Environmental Assessment (Appendix D and available at http://www.dmg.gov/documents.php).
    a. Implement safeguards of the Raven Management Memorandum of Understanding and Environmental Assessment to avoid and/or minimize the potential impacts of this action. These measures include: 1) Implementation of effectiveness monitoring will ensure that common ravens will be removed only when necessary to meet stated objectives. 2) Wildlife specialists will be used to capture and release or dispatch the common raven. 3) The impacts of the program on the common raven will be monitored annually. 4) The impacts of the program on the common raven will be monitored by considering the cumulative take which involves assessing the impacts of all known forms of take against the common raven population estimates and trend indicators. 5) Common ravens that are trapped will not be relocated. They will be euthanized using the most humane methods practicable and offered to museums or laboratories for research purposes.
    b. Implement measures to avoid or minimize impacts on non-target species. 1) The impacts of the removal program on non-target species will be monitored annually. 2) Bait used for the common raven will be as selective as possible for this species, while still maintaining effectiveness. 3) Personnel working to remove the common raven will be trained to identify federal and state endangered and threatened species that may be present and avoid them. 4) Carrion and meat baits will not be used at baiting platforms. 5) Vehicle speeds on non-paved roads in desert tortoise habitat will be limited to 25 miles per hour (mph) for personnel accessing sites to remove common ravens.

c. Conduct effectiveness monitoring and use adaptive management, cooperatively with the existing Raven Management Interagency Task Group. Common raven population trends will be monitored using road surveys both inside and outside the DTHMAs. Trend analysis will also include the Christmas Bird Count survey data and the Breeding Bird Survey data.

d. Reduce human-provided subsidies of food and water; and nest and communal roost sites for the common raven.

   i. Reduce the availability of animal carcasses along roadways.

   ii. Remove common raven nests not occupied with eggs or nestling-remove raven nests from human-created structures within the DTHMAs and along a two-mile perimeter around the DTHMAs.

   iii. Remove or modify man-made communal roosting sites for ravens.

   iv. Remove or modify human-provided nest sites for ravens.

e. Remove ravens that prey on the desert tortoise.

   v. Evidence of predation consists of either locating a minimum of one desert tortoise shell showing the classic peck marks of raven predation within one mile of a nest (Boarman 2002b) or direct observation of a common raven preying or attempting to prey on a desert tortoise. All raven pairs documented as desert tortoise predators will be removed.

   vi. Remove predatory ravens-Common ravens will be removed using the most appropriate humane and safe method. Removal methods could include shooting, using an avicide (DRC-1339), or live trapping and euthanasia. The ravens will be preserved and offered to researchers to collect data on diseases (e.g. West Nile Virus and avian influenza), genetics, or for museum collections. Young ravens and eggs found in nests of removed adults will be euthanized after being removed from the nest.

   vii. Due to the legal authorities and recognized expertise of Animal, Plant and Health Inspection Service-Wildlife Services in wildlife damage management, the lead and cooperating agencies implementing lethal removal of ravens will contract this work to Wildlife Services to be performed by their trained professional staff.

   viii. The USFWS will use the Wildlife Services Decision Model (Slate et al. 1992) as adopted from the Animal, Plant and Health Inspection Service-Wildlife Services decision-making process, which is a standardized procedure for evaluating and responding to wildlife damage complaints.

O.3 Inyo California Towhee (*Pipilo crissalis eremophilus*): Threatened

Related Sections

3.5.6 Birds
3.5.8.3 Inyo California Towhee

Management Strategy for Inyo California Towhee

Project Summary	Legal Driver
Continue to conduct surveys and population assessments in the known range of the towhee and continue to	ESA, DoD

investigate other potential habitat in the North Range.	Partnership
Continue habitat protection and enhancements, such as controlling horse and burro numbers and access in riparian areas and controlling invasive plants. Consider initiating habitat recovery monitoring in habitat impacted by wildfires.	ESA, EO 13186

O.3.1 Benefits Derived from Management Actions Proposed in the INRMP

Benefits from the management plan for Inyo California towhee arise from general habitat enhancement that is specific to this species as well as incidental benefits from the management of other sensitive species. Implementation of the plan includes:

I. Continued participation in the achievement of the recovery plan and other regional planning initiatives to help establish stable towhee populations.

II. Removal of invasive plant species from towhee habitat.

III. Dissemination of towhee status information and outreach materials for public education.

O.3.2 Schedule of INRMP Implementation

Management of the Inyo California towhee on NAWS-CL is now guided by the Cooperative Management Agreement that the installation entered into in 2010.

The schedule for the implementation of the INRMP with completion dates for projects will be shown in Chapter 6.

O.3.3 Effectiveness of INRMP

(1) Biological Goals

The primary biological goal is to ensure long-term population viability of the Inyo California towhee on NAWS-CL through planning consideration.

The design to accomplish this effort includes: conducting long-term monitoring, feral horse and burro removal, fencing of riparian areas, and invasive plant removal. As part of this plan, work to be conducted includes the following:

I. Conduct range-wide surveys for towhees to determine population status; this should include concurrent surveys for brown-headed cowbirds.

II. Enhance springs impacted by horses by fencing areas and maintain adjacent upland habitat in good condition for towhee use for foraging and nesting.

Guiding principles and measurable targets to determine whether goals are being reached need to be devised.

(2) Progress Achievement Standards

One way that the achievement of this plan can be successfully accomplished is to coordinate with the Bureau of Land Management and the California Department of Fish and Game to manage NAWS-CL towhee habitats in a

manner that is compatible with the designated Critical Habitat in adjacent Bureau of Land Management and state lands.

Scientific standard parameters to demonstrate objectives are met successfully need to be identified.

(3) Monitoring and Adaptive Management

Working together with adjacent property managers in order to develop a comprehensive understanding of this species' status is critical to generate a sufficient monitoring and management program. This can be made possible by:

I. Develop procedures to permit regular assessment of the status of towhee populations.

II. Continue long-term monitoring in conjunction with the Bureau of Land Management and California Department of Fish and Game.

(4) Reporting

The reporting associated with the efforts targeted towards the Inyo California towhee recovery will be based on the level of evaluation and the extent of the effort as well as compliance with the implementation schedule.

(5) Projected Effort

There are a few management directives that allow for a basic survey performance schedule and if followed will contribute to further understanding of this species and its status on NAWS-CL.

I. Follow the existing BO to conduct routine maintenance and other activities within towhee habitat.

II. Survey all known and potential towhee habitat at least every five years.

III. To ensure comparability of data, surveys should cover all towhee habitats simultaneously.

Generally speaking, the period of performance is dependent on the time required to achieve the benefits, goals, and objectives of the management plan.

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Appendix P: Reporting on Migratory Bird Management

Migrations are energy-costly, and birds require food and water sources as well as cover, enroute. Because birds use traditional flyways, they are often dependent on water sources enroute. During migration, especially over desert areas where water is scarce, open water is a crucial resource for resting and foraging. These resources may prevent further decline of populations for bird species listed or proposed for listing. Such resources can be found on Naval Air Weapons Station China Lake (NAWS-CL) in various forms: riparian areas; grassy areas; springs and seeps; natural ephemeral water such as dry lake beds (playas); tenajas; washes; and man-made waters such as the evaporation/percolation ponds, located at the Wastewater Treatment Facility and the Lark Seep System.

NAWS-CL has over 70 special status bird species documented, or expected to occur, including several that are the focus of regional desert and Great Basin sagebrush habitat conservation plans. The land management decisions of federal agencies including the Navy could have a large impact on global populations of desert breeding birds due to their tendency to have small, sedentary populations (California Partners-in-Flight [CalPIF] 2009).

Migratory Bird Treaty Act and Migratory Bird Rule

The Migratory Bird Treaty Act (MBTA) of 1918 is the primary legislation in the United States established to conserve migratory birds. It implements the United States' commitment to four bilateral treaties, or conventions, for the protection of a shared migratory bird resource. The MBTA prohibits the taking, killing, or possessing of migratory birds, unless permitted by regulation.

The Migratory Bird Rule relates to military readiness activities and was established in accordance with Section 315 of the National Defense Authorization Act for 2003. The final rule, Migratory Bird Permits: Take of Migratory Birds by the Armed Forces, was published as 50 Code of Federal Regulations Part 21 in the 28 February Federal Register (pg. 8931-8950). It authorizes the military to "take" migratory birds under the MBTA without a permit, but if the military determines that the activity will "significantly" affect a population of migratory birds, they must work with the U.S. Fish and Wildlife Service (USFWS) to implement conservation measures to minimize/mitigate the effects.

While authorized to take migratory birds as a general matter during readiness activities pursuant to the MBTA Rule, it is incumbent upon the Navy to remain cognizant of the possibility that certain readiness activities will fall outside the scope of the Rule if the Navy determines that such activity or activities may result in a significant adverse effect on a migratory bird species at a population level. In remaining cognizant of this possibility, it is necessary to understand the potential of the following terms:

- Population, as used in Section 21.15, is a group of distinct, coexisting (conspecific) individuals of a single species, whose breeding site fidelity, migration routes, and wintering areas are temporally and spatially stable, sufficiently distinct geographically (at some time of the year), and adequately described so that the population can be effectively monitored to discern changes in its status.

- Significant adverse effect on a population, used in Section 21.15, means an effect that could, within a reasonable period of time, diminish the capacity of a population of migratory bird species to sustain itself at a biologically viable level. A population is "biologically viable" when its ability to maintain its genetic diversity, to reproduce, and to function effectively in its native ecosystem are not significantly harmed. This effect may be characterized by increased risk to the population from actions that cause direct mortality or a reduction in fecundity. Assessment of impacts should take into account yearly variations and migratory movements of the impacted species. Due to the significant variability in potential military readiness activities and the species that may be impacted, estimates of significant measurable decline will be determined on a case-by-case basis.

Any conservation measures undertaken pursuant to a finding of population-level significant adverse effect under the Migratory Bird Rule require monitoring and record-keeping for five years from the date the Armed Forces commence their conservation action. During Integrated Natural Resources Management Plan (INRMP) reviews, the Armed Forces must report to the USFWS any migratory bird conservation measures implemented and the effectiveness of the conservation measures in avoiding, minimizing, or mitigating take of migratory birds.

Executive Order 13186 and DoD-USFWS Migratory Bird MOU

For U.S. Department of Defense (DoD) activities other than military readiness, migratory bird concerns are addressed through a Memorandum of Understanding (MOU) (Federal Register 30 August 2006), developed in accordance with Executive Order (EO) 13186 Responsibilities of Federal Agencies to Protect Migratory Birds (10 January 2001). The MOU that evolved out of the requirements of the EO addresses the conservation of migratory birds on military lands in relation to all activities, except readiness. The MOU is a guidance document detailing how the DoD will conserve migratory birds and does not authorize any take. In April 2007, further guidance was issued by the Under Secretary of Defense for Acquisition, Technology and Logistics that covers all activities at NAWS-CL, including natural resources management, routine maintenance and construction, industrial activities, and hazardous waste cleanups. The guidance emphasizes interdisciplinary collaboration in the framework of North American Bird Conservation Initiative (NABCI) Bird Conservation Regions, collaborative inventory and long-term monitoring. The EO directs executive departments to take certain actions regarding the protection of migratory birds.

A Council for the Conservation of Migratory Birds was established to help agencies implement the EO. The EO requires National Environmental Policy Act (NEPA) evaluations to include effects on migratory birds and that advance notice or annual reports must be made to the USFWS concerning actions that result in the taking of migratory birds. The EO also requires agencies to control the establishment of exotic species that may endanger migratory birds and their habitat. Pursuant to its MOU, each agency shall, to the extent permitted by law and subject to the availability of appropriations and within Administration budgetary limits, and to the extent practicable:

- Avoid or minimize adverse impacts on migratory bird resources when conducting agency actions;
- Restore and enhance the habitat of migratory birds;
- Prevent or abate the pollution or detrimental alteration of habitats used by migratory birds;
- Incorporate migratory bird conservation principles, measures, and practices, into agency plans and planning processes and coordinate with other agencies and nonfederal partners in planning efforts;
- Promote programs and recommendations of comprehensive migratory bird planning efforts such as Partners in Flight (PIF), North American Waterfowl Management Plan, as well as guidance from other sources;
- Ensure that environmental analyses evaluate the effects of actions and agency plans on migratory birds;

- Notify the USFWS of actions that have or will result in take of migratory birds;
- Minimize the intentional take of species of concern consistent with appropriate sections of 50 Code of Federal Regulations parts 10, 21, and 22;
- Identify where take is likely to have a measurable negative effect on migratory bird population. Develop practices that will lessen unintentional take regularly evaluate and revise these practices. Inventory and monitor bird habitat and populations to facilitate decisions about the effectiveness of conservation efforts;
- To the extent authorized control establishment of exotic animals and plants that may be harmful to migratory bird resources;
- Promote conservation research and information exchange and share such information with USFWS, the U.S. Geological Service-Biological Resources Division, and other appropriate agencies and institutions Provide training and information to appropriate employees on ways to avoid or minimize the take of migratory; and
- Develop partnerships with non-federal entities to further bird conservation.

Assessment of Migratory Bird Reporting Capability

While it does not seem likely that the Navy's readiness activities would result in a population-level significant adverse effect to any migratory bird species, there would be at least a somewhat-greater possibility that such effects could occur with respect to the following four species of birds protected under the MBTA: the golden eagle, prairie falcon, burrowing owl, and Le Conte's thrasher. Prairie falcons typically nest on cliffs and rock outcrops. Sea-van targets mimic this habitat; NAWS-CL managers documented a pair nesting in a sea-van stack in 2011. Prairie falcons are uncommon at NAWS-CL and occur at very low densities.

The burrowing owl is a NAWS-CL Special Status Species and a USFWS Bird of Conservation Concern. Burrowing owls use burrows and holes for nesting and roosting. Holes under sea-vans and other targets that are created by construction, testing, or other means can be attractive to burrowing owls. Though the Mojave population is believed stable, low population numbers elevate risks for the species. There is little data on burrowing owl populations at NAWS-CL, but their tolerance of human disturbance and habitat preferences indicates they are somewhat more at risk of being adversely affected by testing activity.

Le Conte's thrasher is a non-migratory bird that is restricted to open desert habitat. It is fairly common at NAWS-CL, but is highly sensitive to disturbance and occurs at low densities. Many of the existing target areas at NAWS-CL overlap with Le Conte's thrasher habitat, including the Airport Lake, Baker, and Superior Valley targets. As with most of the bird life at NAWS-CL, very little population level data is available. However, the species' ecology and habitat put it at greater risk of adverse effects from testing activities.

The bank swallow (*Riparia riparia*) and willow flycatcher (all three subspecies) are common migrants, whereas the bald eagle (*Haliaeetus leucocephalis*), Swainson's hawk (*Buteo swainsoni*), western yellow-billed cuckoo (*Coccyzus americanus occidentalis*), and least Bell's vireo are extremely rare migrants. The bald eagle and Swainson's hawk are non-resident species that depend on water bodies and grasslands, respectively. The flycatcher, cuckoo, vireo, and swallow are neotropical migrants that depend on the wetlands and riparian habitats on the NAWS-CL during their migrations. On two occasions immature California brown pelicans, which are a California Fully Protected species (former federally threatened, delisted 17 December 2009) have been observed at Lark Seep.

Although it does not appear that military readiness activities at NAWS-CL have a meaningful potential at present to have a significant adverse effect on a migratory bird species population, it would be desirable to implement a

long-term monitoring protocol to more fully develop knowledge concerning the status of avian populations, consistent with mission execution requirements, availability of funding, and other relevant factors. Such monitoring could also facilitate informed management decisions for sensitive species and could be used in all NAWS-CL planning. Such a monitoring protocol could include, but is not limited to, the following elements:

- *Adequate habitat representation.* Monitoring should attempt to provide a representative sample of the major habitats found at NAWS-CL.
- *Repeatability.* Monitoring protocols should be simple enough to be repeated by any qualified person without extensive training in methodology. Protocols should not be based on limited access or specialized training and equipment.
- *Feasibility.* Any monitoring effort needs to be able to be fulfilled by personnel with limited time and access. Design should seek to minimize the amount of resources needed to collect accurate and useful data.
- *Scientific rigor.* Monitoring protocols should be based on the best available science. The data collected in a way that makes it valuable for a wide variety of management applications, including relative abundance estimates, trend analysis, habitat preferences, and rough density estimation.

Stationary targets such as tanks, sea-vans, and other structures often provide suitable nesting or roosting substrates for many avian species. Although it is unknown to what extent these targets are being used, evidence of roosting and nesting has been found, and such roosting and nesting likely represents the highest risk of migratory bird "take" due to readiness activities at NAWS-CL. However, the possible presence of migratory bird species in such structures during testing events does not appear to present a risk of population-level significant adverse effect, and therefore development of further data concerning the presence of such species within target structures is not required for purposes of the Migratory Bird Rule. (It should also be noted that, insofar as individual birds or a nesting pair could potentially be present in a test or target area, visual sweeps conducted prior to test events will generally afford an opportunity to either re-align a test event, or physically remove any such migratory birds, within mission execution constraints.) NAWS-CL could potentially conduct surveys at target areas during the breeding season (March - June), consistent with availability of funding and mission execution considerations, both to learn more about the use of target areas by migratory bird species, and to explore the feasibility of developing measures to further minimize any impacts to avian species potentially present during test events.

Environmental Management Division (EMD) and tenant command staff will jointly develop a Standard Operating Procedure/Best Management Practice (SOP/BMP) for managing MBTA species activities around target, test, or training areas. The purpose of the SOP/BMP will be to acquire data on observed MBTA populations, minimize potential effects to MBTA species and other non-listed species in the proximity test, target and facility operations, and perform these management actions in a manner that is compatible with the execution of mission requirements.

In accordance with any such attempt to further minimize impacts to migratory birds, avian access to targets for use in nesting would ideally be limited to the extent practicable. Such potential measures could include:

- Covering large open holes
- Restricting or eliminating suitable perches near possible nest sites
- Removing nesting material from targets during the non-breeding season
- Using hazing methods for seven days before conducting a test on a target with known avian use
- Mitigation of impacts

- Monitoring efforts will not be able to identify every raptor nest prior to a test. EMD will rely on range personnel to notify them of any nest found at a target during test preparations.
- If a nest without eggs or young is found, the nest should be removed by EMD personnel.
- If a nest with eggs is found, the eggs and nest may be removed and held for the duration of the test.
- If a nest with young is found, the young and nest may be removed and held for the duration of the test. If the young are old enough, they may be removed and turned over to a rehabber for care and eventual release.
- If possible, do not remove used or spent targets until after the breeding season, if possible.

No comprehensive baseline surveys have been conducted for birds across the range of habitats found at NAWS-CL. Bird species of the southwestern deserts tend to have smaller populations and smaller breeding ranges, rendering these species more vulnerable to ecological stresses (Rich et al. 2004). The land management decisions of federal agencies such as the Navy could have a large impact on global populations of Mojave Desert breeding birds (CalPIF 2009).

Sedentary species are more vulnerable to environmental impact at the population level. For this reason several desert species (i.e. Le Conte's thrasher) have been assigned special status designations (CalPIF 2009). For sedentary species, habitat fragmentation and barriers to movement can result in local population extirpation (Laudenslayer et al. 1992). See Section 3.5.8.3 for the Inyo California towhee, which also falls into this category.

Fires resulting from Research, Development, Acquisition, Testing and Evaluation (RDAT&E) activities are unlikely to have a significant impact on the population of the majority of avian species at NAWS-CL. However, several high elevation habitats including Pinyon Pine, Joshua Tree Woodland, and Great Basin Scrub are limited in extent within the Indian Wells Valley. Populations of avian species restricted to these habitats, such as the black-throated gray warbler, cactus wren, and Scott's oriole, have the potential to be significantly impacted by large fire events. The frequency and likelihood of such a large fire event is unlikely as there have been only 21 fires in the last 15 years on the North Range. These fires have burned an average of 73 acres per year with a maximum of 450 acres in 2011.

INRMP Migratory Bird Objectives

Table P-1 below shows projects that are programmed for implementation for migratory birds. The objectives and guidelines show a synopsis of practices and strategies to be undertaken as practicable.

Table P-1. Projects programmed for implementation for migratory birds.

Project	Legal Driver
Migratory Bird Rule Data Support - Establish a monitoring program to assess baseline bird population levels to facilitate the assessment of effects of range testing operations. Implement annual reporting of migratory bird impacts from range operations. Continue to develop and refine minimization and mitigation measures if significant population impacts are found or suspected to be occurring.	MBTA-Migratory Bird Rule
Continue to develop and enhance baseline data on presence, activity, and use areas for migratory birds. Incorporate monitoring and reporting requirements from the Raven MOU.	Sikes Act, MBTA, EO 13186, MBTA-Migratory Bird Rule
Develop a habitat protection, enhancement and management plan for focus species, building on habitat value and use area maps for birds, including enhanced management at wastewater treatment ponds.	MBTA-Migratory Bird Rule, EO 13186
Continue to implement the NAWS-USFWS Inyo California Towhee MOA intended to facilitate delisting of this species.	ESA
Continue to work with other wildlife management agencies on bird census, survey, trapping, banding, and translocation efforts.	Sikes Act, EO 13186

Objectives and Guidelines for Birds

Objective: *Maintain, restore, and enhance habitats that provide for the health of resident and migratory populations of emphasizing special status species that may be affected by military activities.*

See also Section 4.8.1.3 for details on Inyo California towhee management and the NAWS-CL /USFWS MOA on this species for de-listing.

Objective: *Implement provisions and requirements of the military readiness waiver under the MBTA.*

Metric: *NAWS-CL complies with all applicable laws and regulations, including the MBTA Readiness Waiver. Current management practices continue to provide protection for birds. Population status and habitat use of avian species at NAWS-CL continue to be studied, with particular emphasis on sensitive species or species with limited distribution. Continued research support, surveys, and agency partnerships enhance knowledge and protection of avian populations.*

I. Implement habitat-based strategies for conservation of migratory birds (EO 13186).

A. Continue implementing the NAWS-CL/USFWS Inyo California towhee MOA intended to facilitate the delisting of this species.

B. Identify high-value habitats to facilitate development of avoidance and minimization.

1. Develop a NEPA checklist of best practices for the site approval process.
    a. See Appendix N Section III below, or consult the Partners In Flight list: (http://www.partnersinflight.org/pubs/BMPs.htm).
    b. Develop installation-level BMPs. See DoD PIF-L List Serve (http://www.dodpif.org/).
2. Map high value habitats for management-focus species. Consider the target habitat conditions identified in California desert, and sagebrush bird conservation plans.

C. Protect and manage priority habitats for migratory birds.

1. Implement long-term conservation priorities based on habitat value mapping.
2. Minimize encroachment into the springs, seeps, and washes.
3. Develop a habitat protection, enhancement, and management plan for management focus species building on habitat value and use area maps. Develop a restoration plan to benefit management focus birds.
    a. Establish and prioritize specific habitat restoration and enhancement objectives.
    b. Improvements to existing habitats include wetland protection and maintenance, and control of invasive plant and animal species.
    c. Promoting vegetation structural diversity and volume of the understory.
    d. Prioritize riparian, seep, or spring sites for restoration or enhancement based on avian population health; proximity to existing high-quality sites; sites with intact adjacent uplands; sites with an intact or recoverable natural hydrology and sites with compatible surrounding land.
    e. Promote self-sustaining spring/seep/riparian functions. Ensure that the patch size, configuration, and connectivity of restored habitats support the desired vegetation structure, hydrology and species diversity.
4. Implement site-specific restoration.
    a. Restore uplands in conjunction with riparian, spring, or seep restoration. Riparian fences should include substantial areas of adjacent upland habitat.
    b. Example projects include:

i. Installation of fences and exclusion panels around seeps and springs, and towhee habitat.
ii. Removal of tamarisk and other invasives.

II. Comply with conservation targets for special status bird populations.

A. Identify priority species for focused management (see Table 3-9.)

B. Continue to maintain and update the installation bird checklist.

C. Report the results of bird surveys to the national military DoD Bird Conservation Database.

D. Continue mountain quail management efforts.

III. Protect migratory bird populations by avoiding or minimizing.

A. Implement installation-level avoidance and minimization measures.

1. Communications tower construction should consider USFWS and PIF guidance for construction (see Chapter 5) (DoD-USFWS MOU).
2. Identify power lines and poles known to electrocute raptors and correct design deficiencies.
3. Control access into and disturbance of nesting and breeding grounds during critical periods.
4. Reduce pesticide use to minimize effects on birds (see also 5.6 Landscaping and Grounds Maintenance).
5. Encourage restraint of household pets. Promptly address issues associated with feral cats and dogs.
6. Consider use of artificial habitat features such as nest boxes and guzzlers. Avoid areas managed for desert tortoise.
7. When possible redirect construction and military operations away from cliffs, burrowing owl colonies, and other high-value areas.

B. Facilitate compliance with the Bird/Animal Air Strike Hazard (BASH) Plan (See Chapter 5).

IV. Develop and enhance conservation partnerships to further the work of bird conservation (EO 13186, DoD-USDI MOU, Undersecretary of Defense Memo [2007], Sikes Act [as amended]).

A. Integrate the population goals and objectives of regional conservation plans into all planning and environmental documents.

1. Actively support bird conservation groups and continue to support the Kerncrest chapter of the Audubon Society in conducting bird surveys on the NAWS-CL, including the annual Audubon Christmas Bird Count.

B. Continue to coordinate and collaborate with conservation partners. (U.S. NABCI, EO 13186, DoD-USFWS MOU, and Undersecretary of Defense Memo [2007]).

C. Continue to promote comprehensive migratory bird planning efforts such as the West Mojave Plan and previously mentioned conservation efforts.

1. Attend PIF meetings or other significant bird events. Use information collected from partnership programs to better support DoD mission requirements.

V. Conduct inventory and monitoring for the adaptive management of birds.

A. Establish a long-term monitoring program for reporting on the status of key avian species and populations at NAWS-CL (MBTA, EO 13186, Undersecretary of Defense Memo [2007]).

1. Represent all key habitat types in the survey design.
2. Coordinate efforts with the DoD Coordinated Bird Monitoring Plan and other guidance documents. Conduct timed breeding bird surveys on established routes in key habitats or sensitive areas.

B. Monitor effectiveness of bird management practices and adjust management strategies as needed.

VI. Improve awareness of migratory bird stewardship through education, outreach, and public access.

A. Provide training and information.

1. Continue to conduct briefings and biomonitoring of construction and maintenance work to ensure compliance with the MBTA.

B. Consider establishment of Watchable Wildlife Areas and promote the economic and recreational values of migratory birds (EO 13186).

C. Continue to support chukar hunting for both military personnel and the general public.

VII. Support research proposals of local institutions that provide a benefit to conservation of migratory birds (Undersecretary of Defense Memo 2007).

A. Support research through the DoD Legacy Program (http://www.dodlegacy.org).

B. Support research through DoD's Strategic Environmental Research and Development Program.

VIII. Support pilot demonstration projects through DoD's Environmental Security Technology Certification Program (http://www.estcp.org). Comply with the take avoidance and reporting requirements that relate to the MBTA and the Endangered Species Act (ESA).

A. Comply with the military readiness MBTA-Migratory Bird Rule.

1. Develop and implement conservation measures if an action may have a significant adverse effect on a migratory bird population.
    a. Identify species which may be impacted, and the activities that may affect them.
        i. Determine if the identified impacts are significant (as defined in the Migratory Bird Rule).

B. Analyze and manage effects of any wildfires caused by military readiness activities on bird populations. Comply with the MBTA for non-readiness activities.

1. Intentional Take. Minimize incidental take from non-readiness activities Develop a protocol for routine maintenance activities such as mowing, tree trimming, herbicide application, etc.
    a. Update and acquire depredation permits as needed. Comply with permit conditions.
    b. Ravens will be managed in a manner to protect the desert tortoise (ESA, NEPA, MBTA).

IX. Focus management efforts at high value sites such as springs and riparian areas.

A. Enhance and restore riparian, spring, seep, and wetland habitats.

1. Encourage vegetation diversity and watershed protection at springs and seeps.
2. Continue to reduce burro and horse numbers where they have a detrimental effect on riparian and other sensitive habitats.
3. Protect and restore unusual plant assemblages classified as wetland riparian (California Wildlife Action Plan).

B. Complete assessments of spring and seep vegetation. Take actions necessary to achieve a healthy condition and take steps to minimize effects of erosion or sedimentation, invasion by non-natives that affects habitat value, or other impact.

C. Implement measures to protect riparian areas, such as fencing and/or the provision of alternate water sources away from the water source.

Appendix Q: Research and Partnership Projects

Suggested Research

- Increase the use of remote sensing and Geographic Information System to maximize the efficiency of field effort, and to collect, compile and disseminate data and information on Mojave, Great Basin, and eastern Sierra soil and vegetation subregions.
- Support research investigating mammal populations, locations, sizes, distributions and habitat requirements.
- Support investigations for the presence of white nose syndrome in local bats.

Cooperative Projects – Currently Ongoing as of 2012

Bureau of Land Management Horse and Burro Management

Funding provided to the Bureau of Land Management to conduct annual horse and burro roundups, using various techniques.

University of California Riverside Invertebrate Surveys and Rare Plant Inventories

Dr. Gordon Pratt has conducted invertebrate surveys on the North and South Range complex at Naval Air Weapons Station China Lake (NAWS-CL) since 1999. Although some of this work is completed through a Cooperative Agreement with University of California Riverside, some of the field work, including surveys using entomology students, is accomplished at no charge to NAWS-CL.

Dr. Pratt is also under contract to conduct surveys for rare, unique, endemic and scientifically interesting species. His primary focus (with regards to plant surveys) is to survey for the Lane Mountain milk vetch, a federally listed endangered species known to occur a few miles south of the South Range (Superior Valley) test complex at NAWS-CL.

U.S. Geological Survey Historical Photography

Dr. Kristin Berry from the U.S. Geological Survey is continuing a study to re-take photographs recovered from the National Archives. Photographs are from the late 1800s to early 1900s. The goal of the study is to determine changes in plant species composition and distribution, primarily as a result of grazing.

U.S. Geological Survey/Bureau of Land Management Tortoise Surveys

Support provides access to the South Range for one or two day periods each year at NAWS-CL. Surveys use the now standardized Line Distance Sampling technique.

Audubon Society Avian Surveys

NAWS-CL has been sponsoring the local Audubon Society to access the ponds at the wastewater treatment facility to conduct bird surveys. They provide an annual report of species seen, numbers and usage frequency by

month. In addition, the Audubon Society sponsors the annual Christmas Bird Count, which has been held on NAWS-CL since the 1950s and the Annual Bird-a-thon.

Nevada Department of Wildlife Chukar and Mountain Quail

This effort provides for the trapping and translocation of chukar and mountain quail. Birds are captured from water sources (either springs or guzzlers) and transplanted to release sites that have been rehabilitated. These efforts have occurred each year since 1998 and have provided birds to Oregon, California, Nevada, Idaho and Colorado resource management agencies. Mountain quail are becoming nearly extirpated in many portions of their range and the reintroduction efforts are an integral part of long-term management efforts by these states.

Quail Unlimited Guzzler Repair

Crews from the local chapter of Quail Unlimited have provided equipment and material to repair guzzlers (game bird drinkers) on the North Range. Its members provide labor, pumps and expertise to complete projects not otherwise affordable.

Appendix R: Summary of Past Natural Resources Surveys

The following chronology (Table R-1) is a compilation of all available references of surveys conducted at Naval Air Weapons Station China Lake (NAWS-CL) and retains incomplete references.

Table R-1. Botanical work chronology and abstracts, Naval Air Weapons Station China Lake.

Year	Surveys/References
1974	Quimette, J.R. 1974. Survey and Evaluation of the Environmental Impact of Naval Weapons Center Activities. Naval Weapons Center, China Lake, California.
1974	Barling, Tilly
1976	Barling, Tilly
1978	Mary Ann Henry's work, mostly 1978, and information, much of which is represented under the work of others, primarily Mary DeDecker (1980) and Beckingham et al. (1981).
1979	Henrickson, J. 1979. Botany of the Coso Geothermal Study Area. In Rockwell International. 1980. Field Ecology Technical Report on the Coso Geothermal Study Area in Support of Geothermal Development Environmental Statement. Bureau of Land Management, Bakersfield, California.
1979	Westec Services, Inc. 1979. Environmental Assessment for Naval Weapons Center Withdrawal of Mohave B Ranges. Technical appendix, 2 vols., prepared for China Lake Naval Weapons Center Public Works Department. 107 pp.
1979	Zembal, R.C., C. Gall, D. Kruska, and P. Lobnitz. 1979. An Inventory of the Vascular Plants and Small Mammals of the Coso Hot Springs Area, Inyo County, California. Department of the Navy, Naval Weapons Center, China Lake, California. 120 pp.
1980	Brandman - Principal-in-charge; L. Munsey - Project Director; Eric Hanson - Senior Investigator; Karlin G. Marsh, Kent K. Norton, Cynthia Gall, Lori Nicholson, and Richard Zembal - Field Investigators. Study occurred on bajada northwest of Black Hills from 31 October to 01 November 1979.
1980	DeDecker, M. 1980. A Flora of the Naval Weapons Center and Bordering Areas in Portions of Kern, Inyo and San Bernadino Counties. Self-published by Mary DeDecker, Independence, California. 51 pp.
1980	Observations based on Mary DeDecker's field surveys and personal herbarium for the region.
1980	Henrickson, J. 1980. Botany of the Coso Geothermal Study Area. In Rockwell International. 1980. Field Ecology Technical Report on the Coso Geothermal Study Area. Bureau of Land Management Report, Bakersfield, California. 6: 97 pp.
1980	Michael Brandman Associates, Inc. 1980. Inventory of the Plants and Vertebrates of the Randsburg Wash Test Range Area. Prepared for the Naval Weapons Center Environmental Branch (Code 2692), China Lake, California; Santa Ana, California. Approx. 30 pp. + appendices.
1980	Phillips, Brandt, Reddick, Inc. and PRC Troups. 1980. Inventory of the Vascular Plants and Vertebrate Fauna of the Randsburg Wash Test Range Area of the China Lake Naval Weapons Center, China Lake, California. 84 pp.
1980	Rockwell International. 1980. Field Ecology Technical Report on the Coso Geothermal Study Area. Newbury Park, California.
1981	Beckingham, Denise.1981. Inventory of the Vascular Plants and Vertebrates at China Lake Naval Weapons Center.
1981	Beckingham, D.L., D. LaBerteaux, J. Lorenzana, and A.P. Woodman. 1981. Inventory of the Vascular Plants and Vertebrates at China Lake Naval Weapons Center. Unpublished Draft Report. 104 pp.

Year	Surveys/References
1981	Thomas McGill- Project Supervisor; Dianne L. Beckingham, Denise LaBerteaux, Juanita Lorenzana, and Peter Woodman - Research Staff, Field Crew and Authors. A field study was conducted from 14 July to 14 September 1981 to inventory vascular plants and vertebrates at four areas of NAWS-CL: Wildrose Spring in Mountain Springs Canyon, sand dunes in the K2 Track area, Lark Seep, and Upper Cactus Flat. Vegetation descriptions were written of the four areas. Quantitative sampling with belt transects (Mueller-Dombois and Ellenberg 1974) Not in ref were completed at the Mountain Springs Canyon (+ one line intercept transect), K2 Track area, and Upper Cactus Flat. A modified belt transect was completed at Lark Seep. These were analyzed for cover, composition, and density (Appendix A- table one) and results described. Plants were identified and collected as vouchers (NAWS-CL herbarium). A plant list was created with cross references to the four study areas (Appendix A - table two). In addition, two other plant lists were presented (Appendix A - table three) from the previous work of Mary Ann Henry at Mountain Springs Canyon (1972-75, 1978) and the K2 Track area (March 1978).
1981	Phillips, Brandt, Reddick, Inc. 1981. Feral Burro Management Program, Naval Weapons Center, China Lake, California. Technical Appendix I to Final Environmental Impact Statement, Irvine, California.
1982	Bagley, Mark. 1982. Baseline Data on Vegetation and Selected Vertebrate Populations. Naval Weapons Center.
1982	May, Richard W. Plants were observed and reported in Distribution and Status of Sclerocactus polyancistrus on the Naval Weapons Center -A Survey, prepared for the Public Works Department by, (Texas A&M?), October 1982 (NWC TP 6403 - 201.02 002).
1982	Threatened and Endangered/PW plants were observed and reported in Naval Weapons Center Resource Management Plan for the Mojave B and Randsburg Wash Ranges. 19 August 1982. Draft copy for Internal Navy Review prepared by Test and Evaluation Directorate and Public Works Department.
1982	Westec Services, Inc. 1983. Biological Resources Survey of Mountain Springs Canyon on the Naval Weapons Center. Unpublished report, Naval Air Weapons Station technical publication (NWC TP 6424) produced by WESTEC Services, Inc., San Diego, California. 82 pp.
1982	John Westermeir - project manager; Stephen Lacey - project coordinator; Jack Fisher - senior botanist; and Thomas Huffman and Curt Uptain - associate biologists. A biological resource study of the 8,500-acre Mountain Springs Canyon at the Station was conducted in May 1982 to update the general biological database for NAWS-CL and gain specific information for future resource management considerations. Birds, mammals, reptiles, amphibians, and plants were surveyed. Plants were identified and presented as a plant list with cross-references to plant communities (Table AA-l). Seven vegetative habitats were identified: Creosote Bush Scrub, Grayia-Lycium, Artemisia-Coleogyne, Haplopappus-Coleogyne, Desert Wash, Riparian Woodland, and Pinyon Pine Woodland. Discussions of general vegetation and plant classification systems as they relate to Mountain Springs Canyon were presented. Extensive plant collections were made for each of the representative areas. Voucher specimens from this study were submitted to University of New York; taxa were keyed to Munz (1979) and common names to Jaeger (1969). Plant species inventories were obtained by general qualitative surveys from May 3-10. Plant communities and associations were determined by general foot survey of the study area. Further quantitative vegetation measurements were completed in each of the representative areas. Belt line transects (50 x 3 meter; [Mueller-Dombois and Ellenberg 1974]) of three randomly-spaced lines were done in close proximity to wildlife study plots. Shrub height, frequency, cover, and density were calculated. Evenly spaced plots for annual plants and substrate were also surveyed along these transects. Riparian areas were sampled by estimation of cover. Sensitive plant species were surveyed, but none were found. The study observed numerous burro-related impacts to vegetation. Statistical comparisons were made between burrobush cover of Mountain Springs Canyon and other sites in the Mojave Desert. Burrobush was found to be significantly reduced in cover size at Mountain Springs Canyon.
1983	Bagley, Mark. 1983. Naval Weapons Center Grazing Range Recovery: Part I. (LaBerteaux, T.,Campbell G., and J.C. Lorenzana.). Draft prepared with Ecological Research Services initially prepared a sensitive plant list to enable NAWS-CL to better manage its lands. The sensitive species list was sorted into species that are known from NAWS-CL, those found within 25 miles of NAWS-CL, and those found in desert areas within 100 miles of NAWS-CL.
1983	Bagley, M.O., D.L. LaBerteaux, T.G. Campbell, and J.C. Lorenzana. 1983. Naval Weapons Center Grazing Range Recovery: Part 1. 1982 Baseline Data on Vegetation and Selected Vertebrate Populations. NWC TP 6436. Naval Weapons Center, China Lake, California. 212 pp.
1983	Phillips, Brandt, and Reddick, Inc. 1983. Riparian Habitat Resources Inventory, Naval Weapons Center, Department of the Navy. Irvine, California. Introduction plus four sections.
1983	July 1983, prepared by Phillips, Brandt, and Reddick, Inc., Irvine, California. (Eric Hansen, Walton Wright and Eric Wier - Field Observers).
1983	Westec Services, Inc. 1983. Biological Resources Survey of Mountain Springs Canyon.
1984	Brandman
1984	Mary DeDecker. 1980. NAWS-CL region flora, 1984 Northwest Mojave.
1984	Feldmath, R.C. and M.O. Bagley. 1984. Biological Resources of the Coso Geothermal Project Area. July 1983, Ecological Resources Services, Inc., Claremont, California. 22 pp.

Year	Surveys/References
1984	Westec Services, Inc. Environmental Assessment for Naval Weapons Center Withdrawal of Mohave B Ranges 1979, prepared for Naval Weapons Center Public Works Department, San Diego, California.
1985	Bagley, Mark O. 1985. Sensitive Plant Species of NAWS-CL and Surrounding Regions, Inyo, Kern and San Bernadino Counties, California. Prepared with Ecological Research Services for the Naval Weapons Center, China Lake, California. Unpublished report on file at Naval Weapons Center, Environmental Resources Management Branch. 227 pp.
1985	Bagley, M.O. Prepared a sensitive plant list to enable NAWS-CL to better manage its lands. The sensitive species list was sorted into species that are known from NAWS-CL, those found within 25 miles of the Station, and those found in desert areas within 100 miles of the Station.
1985	Naval Weapons Center. 1985. Environmental Assessment of the Proposed China Lake Joint Venture Well 63-18, Coso Known Geothermal Resource Area, Inyo Co., Naval Weapons Center, China Lake, California. Prepared for the China Lake Joint Venture and Naval Weapons Center Public Works Department by McClenahan and Hopkins Associates, San Mateo and Kensington, California. 32 pp.
1986	Edwards, E.M. 1986. Coso Monitoring Program, October 1985-September 1986. Naval Weapons Center Public Works Department, Naval Weapons Center, China Lake, California. 99 pp.
1986	Leitner, B.M. and P. Leitner. 1986. Preliminary Report on Biological Resources, Devil's Kitchen to Inyokern 115 Kilovolt Transmission Line. Prepared for California Energy Company, Santa Rosa, California. 27 pp.
1987	Edwards, E.M. 1987. Coso Monitoring Program, October 1986-September 1987. Naval Weapons Center Public Works Department, Naval Weapons Center, China Lake, California. 105 pp.
1987	Leitner, B.M. and P. Leitner. 1987a. Report on Biological Resources on the California Energy Company Navy 2 Field Development and Power Plant Construction Program, China Lake Naval Weapons Center, California. June 12, 1987. Prepared for McClenahan and Hopkins Associates, Kensington, California. 70 pp. + figures.
1987	Leitner, B.M. and P. Leitner. 1987b. Report on Biological Resources, China Lake Joint Venture Bureau of Land Management 1 Field Development and Power Plant Construction Program, China Lake Naval Weapons Center, California. Prepared for McClenahan and Hopkins Associates, Kensington, California. 47 pp. plus figures.
1987	Michael Brandman Associates. 1987. China Lake Naval Weapons Center Sensitive Plant Species Survey (Mark Bagley sensitive plants surveys with other botanists).
1987	U.S. Fish and Wildlife Service. 1987. Biological Resources Inventory, Mohave B - Range South, San Bernadino County, California. Prepared for U.S. Army Corps of Engineers, Los Angeles District by U.S. Fish and Wildlife Service, Laguna Niguel Office, California, 92656 (Heather Hollis, Denise LeBerteaux, Nancy Gilbert Van Cleve, and A. Peter Woodman - field observers).
1988	Leitner, B.M. 1988. 1988 Revegetation Plan for the China Lake Joint Venture Geothermal Development, Coso Known Geothermal Resource Area. Prepared for McClenahan and Hopkins Associates, Kensington, California. 24 pp.
1988	Leitner, B.M. and P. Leitner. 1988a. Report on Biological Resources, China Lake Joint Venture's Navy-2 Field Small Power Plant Exemption Application, Coso Known Geothermal Resource Area, China Lake Naval Weapons Center, California. Prepared for McClenahan and Hopkins Associates, Kensington, California. 43 pp.
1988	Leitner, B.M. and P. Leitner. 1988b. Report on Biological Resources, Proposed 220 kV Transmission Line Project, BIM NWC-2 Power Plant to Inyokern Substation, Coso Known Geothermal Resource Area, China Lake Naval Weapons Center, California. Prepared for McClenahan and Hopkins Associates, Kensington, California. 36 pp.
1988	Leitner, B.M. and P. Leitner. 1988c. Biological Resources of Certain Lands Within the Coso Known Geothermal Resource Area Including Portions of Navy/CUV Contract Lands BLM Lease CA -11402. Prepared for McClenahan and Hopkins Associates, Kensington, California. 59 pp. plus maps.
1988	Plants were observed and reported in November 28,1988 by Barbara Malloch Leitner and Philip Leitner, Oakland, California.
1988	McClenahan and Hopkins Associates. 1988. Draft Environmental Assessment / Environmental Impact Report for the California Energy Company Proposed Plans for Utilization, Development and Disposal for Geothermal Development on Bureau of Land Management Geothermal Lease CA-11402, Coso Known Geothermal Resource Area, Inyo Co., California. Prepared for the Bureau of Land Management, California Desert District and Great Basin Unified Air Pollution Control District. 168 pp. plus appendices.
1988	Michael Brandman Associates, Inc. 1988. China Lake Naval Weapons Center Sensitive Plant Species Survey 1987. Prepared for the Naval Weapons Center Environmental Resources Management Branch, China Lake, California; Santa Ana, California. 55 pp. + appendices (133 total pp.). (Mark Bagley, Tim Krantz-field observers)
1989	Leitner, P. and B.M. Leitner. 1989. First Year Baseline Report, Coso Grazing Exclosure Monitoring Study, Coso Known Geothermal Resource Area, Inyo Co., California. Prepared for McClenahan and Hopkins Associates, San Mateo, California. 69 pp. plus appendices.

Year	Surveys/References
1989	Michael Brandman Associates, Inc. 1989. Phase One, China Lake Naval Weapons Center Creosote Bush Clones Survey and Management Plan. Prepared for the Naval Weapons Center Environmental Branch (Code 2692), China Lake, California; (H.L. Jones), Santa Ana, California. 17 pp. plus appendices and maps.
1990	Leitner, P. and B.M. Leitner. 1990. Second Year Baseline Report, Coso Grazing Exclosure Monitoring Study, Coso Known Geothermal Resource Area, Inyo Co., California. Prepared for McClenahan and Hopkins Associates, Bethesda, Maryland. 96 pp.
1990	Leitner, B.M. and P. Leitner. 1990a. Biological Resources of Geothermal Properties, Inc., Lease Block CA-11932; Sections 23-36, 122s R38E, Coso Known Geothermal Resource Area, Inyo Co., California. Prepared for McClenahan and Hopkins Associates, Bethesda, Maryland. 55 pp.
1990	Leitner, B.M. and P. Leitner. 1990b. Biological Resources of Certain Lands Within the Coso Known Geothermal Resource Area II Including BLM Leases CA-11400, CA-11403 and CA-12937 and Portions of Navy/CUV Contract Lands. Prepared for McClenahan and Hopkins Associates, Bethesda, Maryland. 137 pp. plus appendices. November 19, 1990 by Barbara Malloch Leitner and Philip Leitner, Oakland, California.
1991	Leitner, P. and B.M. Leitner. 1991. Third Year Baseline Report, Coso Grazing Exclosure Monitoring Study, Coso Known Geothermal Resource Area, Inyo Co., California. Prepared for McClenahan and Hopkins Associates, Bethesda, Maryland. 96 pp.
1993	Filemaker records for nomenclature were utilized from this database.
1993	Kiva Biological Consulting. Naval Air Weapons Station, China Lake Sensitive Plant Species Survey, Phase 3. Report of 1993 results, June 1994. Inyokern, California (Mark Bagley, Susan Moore, Dave Charlton, and Tim Krantz - field observers).
1995	Pratt. Plants were observed and reported in Butterflies of 1996.
1995	Pratt misc. plant list
1995	Gordon Pratt and Andy Sanders -DC Riverside 1995. Butterfly document for China Lake, Edwards Air Force Base and Fort Irwin, 1996 misc. - plant list of recent floristic observations.
1996	Bagley DB 1996
1996	Silverman. 1996. Plants were observed and reported in vegetation map metadata.
1996	Silverman DB 96 - records added after Kiva and Bagley DB inputs.
1996	Dave Silverman. 1996. Geographic Information System Vegetation map, Plant list database, Floristic surveys.

Ongoing Surveys that Include Long-Term Data Sets (Current and Historic), Funded Through Navy Budget Process

Desert Tortoise Surveys

Surveys of areas proposed for use by Range Operations, as well as areas suspected of supporting (relatively) high densities of tortoises, are annually funded.

Inyo California Towhee Surveys

Surveys of portions of known and potential towhee habitats is an annually funded effort designed to assess population levels, breeding success, dispersal of young, and effects of Range Operations fires.

Mohave Tui Chub Surveys

The Lewis Center provides monthly water quality sampling, annual cattail removal and population estimation (mark/recapture) for the Mohave tui chub. It has also provided assistance with relocating chub to other refugia.

Range Habitat Monitoring

Funds provide for vegetation monitoring to assess utilization associated with horse and burro use. This project repeats transects at vegetation plots established in 1982 and 1983, which are designed to assess recovery of the vegetation following horse and burro removals. Plant transects have also been established to monitor recovery of perennial vegetation in burn areas.

Past Cooperative Project Support-Not Currently Active

Toad Surveys

Genetic research started in 2005 on speciation of western toads found throughout the Great Basin desert of western North America. A half-day field trip to collect genetic material from a known population at Haiwee Spring was most recently conducted. Work was done by graduate students from the University of Nevada, Reno.

Burn Area Recovery Surveys

The local chapter of the California Native Plant Society assessed vegetation recovery in the burn zones over a one or two day period during the spring or early summer months.

Raptor Surveys

Dr. Peter Bloom, from the California State Parks Raptor Research Center, conducted satellite/radio collar tracking of a red-tailed hawk, and did a raptor survey in the 1980s at NAWS-CL. An associated effort has been made to band burrowing owls in support of a California Department of Fish and Wildlife (CDFW) range-wide assessment effort with Dr. Bloom's assistance.

Riparian Area Snails

Darrell Wong, biologist for the CDFW, has collected snails from springs along the west slope of the Argus Mountains to support research of rare and endemic species at NAWS-CL.

Lake Playa Shrimp

Various researchers from the CDFW, private contractors and others from academic institutions have done periodic shrimp surveys of lake playas throughout the North Range.

Bighorn Sheep and Large Mammal Surveys

Bighorn sheep were re-introduced into the Eagle Crags Mountains in 1983 and 1985. Since, periodic ground-based and helicopter surveys have been completed to assess their numbers, locations, health and reproductive success. Thirteen ewes were released in 2006 to augment the herd. Surveys have been coordinated with personnel from the CDFW.

Bat Surveys

Bat surveys at NAWS-CL were conducted by contractors and through use of volunteers. Work has primarily been accomplished by Dr. Pat Brown-Berry and has focused on the Townsend's big-eared bat. A total of 11 species have been observed that were mist netted or detected with ultrasound receivers.

Botanical Surveys

Local botanist Dave Silverman has conducted botanical resources surveys on both the North and South Ranges, such as for the Lane Mountain milk-vetch (a federally listed species). Voucher specimens are provided to University of California (U.C.) Riverside, Rancho Santa Ana herbarium, or the Santa Barbara Botanical Garden.

Tennessee Spring Snail Survey

Dr. Robert Hershler has collected snails from Tennessee Spring on behalf of the National Museum of Natural History (Smithsonian Institution) to support research on the systematics of gastropods.

Creosote Clone Surveys

Dr. Frank Vasek from the Southwestern Museum has documented numerous creosote clone rings. He states NAWS-CL is home to the largest known creosote ring, which may be the oldest living plant on Earth. This plant totals hundreds on NAWS-CL, primarily associated with dune systems in the southern Argus Range.

Prairie Falcon Study

Dr. Douglas Bell, East Bay Regional Park District Program Manager, requested to band and take blood samples from prairie falcon chicks at nest sites on NAWS-CL. His intent is to utilize blood sampling to study population genetics and the convergence/divergence of prairie falcon populations.

Graduate Studies Support

Various university graduate studies have been supported by NAWS-CL. A Cornell University graduate student collected skinks from the Birchum Springs area. A U.C. Berkeley student studied dune weevils (east of the K-2 Track) and beetles restricted to a single species of salt bush (near China Lake playa). Sarah Crews, graduate student from U.C. Berkeley, conducted research at NAWS-CL on lakebed spiders. A Ph.D candidate from Tufts University in Boston completed her third and last field season at NAWS-CL in 2009. Her efforts were designed to study capture stress responses in chukar, an introduced (non-native) game bird.

Slender Salamander Surveys

Ted Papenfuss from U.C. Berkeley installed and checked can/pitfall traps to survey for slender salamanders and other amphibian species at numerous water sources on the North Range. Over 80 can traps (currently sealed shut) were installed.

Appendix S: Natural Resources Metrics

Natural Resources Conservation metrics must be annually reported to Congress as part of a broader national initiative to improve government performance. Figure S-1 depicts the Navy conservation website, where the metrics builder can be found.

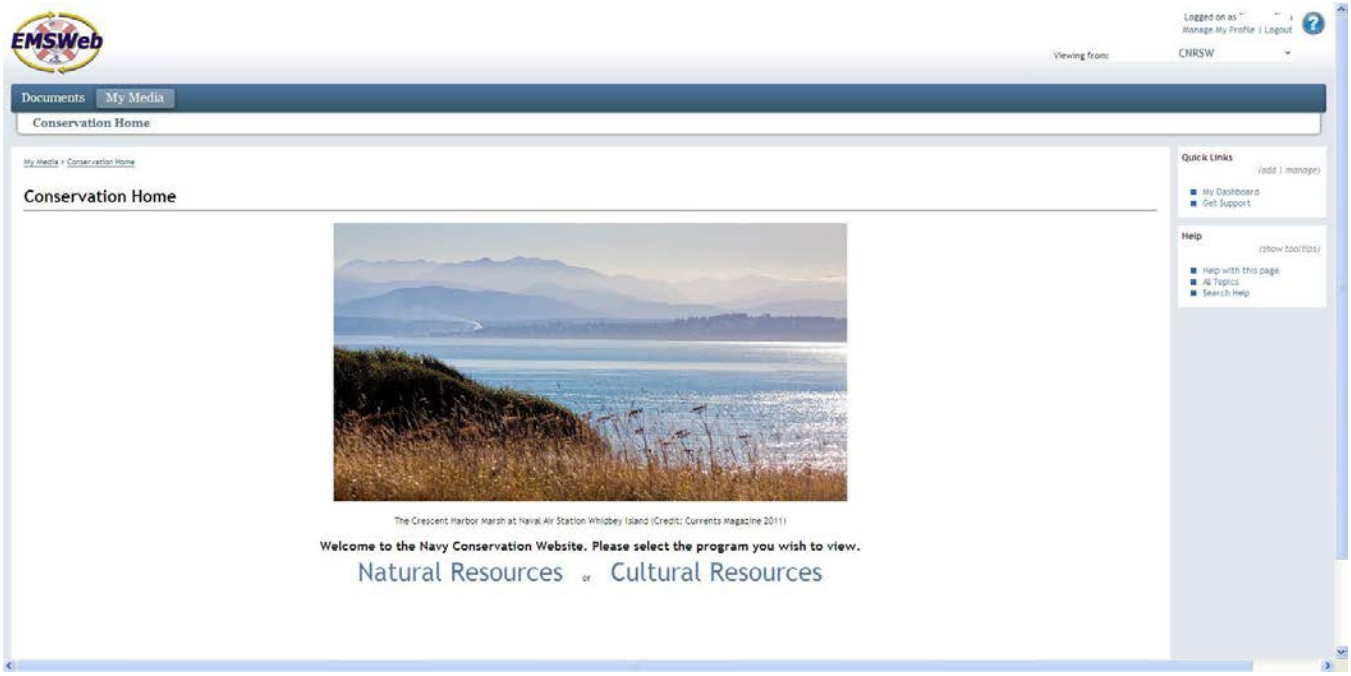

Figure S-1. Navy Conservation Website, where the metrics builder can be found.

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FY11 Defense Environmental Programs Annual Report to Congress (DEPARC) – Natural Resources Data Summary

Introduction

In accordance with DoDI 4715.03, *Natural Resources Conservation Program,* and the Sikes Act Improvement Act, the Deputy Under Secretary of Defense (Installations and Environment) requires environmental management information to support Congressional reporting and ensure DoD is on track to meet its environmental management goals. Consequently, the Navy Natural Resources (NR) Metrics were developed to support the annual Natural Resources Program reviews between the Navy and its Sikes Act partners, the USFWS and State Fish and Wildlife agencies. These NR Metrics can be used to gather and report essential information required by Congress, Executive Orders, existing U.S. laws, and the Department of Defense. There are seven Focus Areas that comprise the NR Metrics to be evaluated during the annual review of the Natural Resources Program/INRMP.

1. Ecosystem Integrity
2. Listed Species and Critical Habitat
3. Fish and Wildlife Management for Public Use
4. Partnership Effectiveness
5. Team Adequacy
6. INRMP Project Implementation
7. INRMP Impact on the Installation Mission

Each of the seven Focus Areas contains questions that can be evaluated. Questions are weighted, with responses to questions having different values, ranging from 0.0 to 1.0. Each Focus Area is scored, using a rating scheme of Green (1.0-0.67), Yellow (0.66-0.34), and Red (0.33-0.0), resulting in a comprehensive scorecard for the entire NR Metrics for each Navy installation (Figure 1).

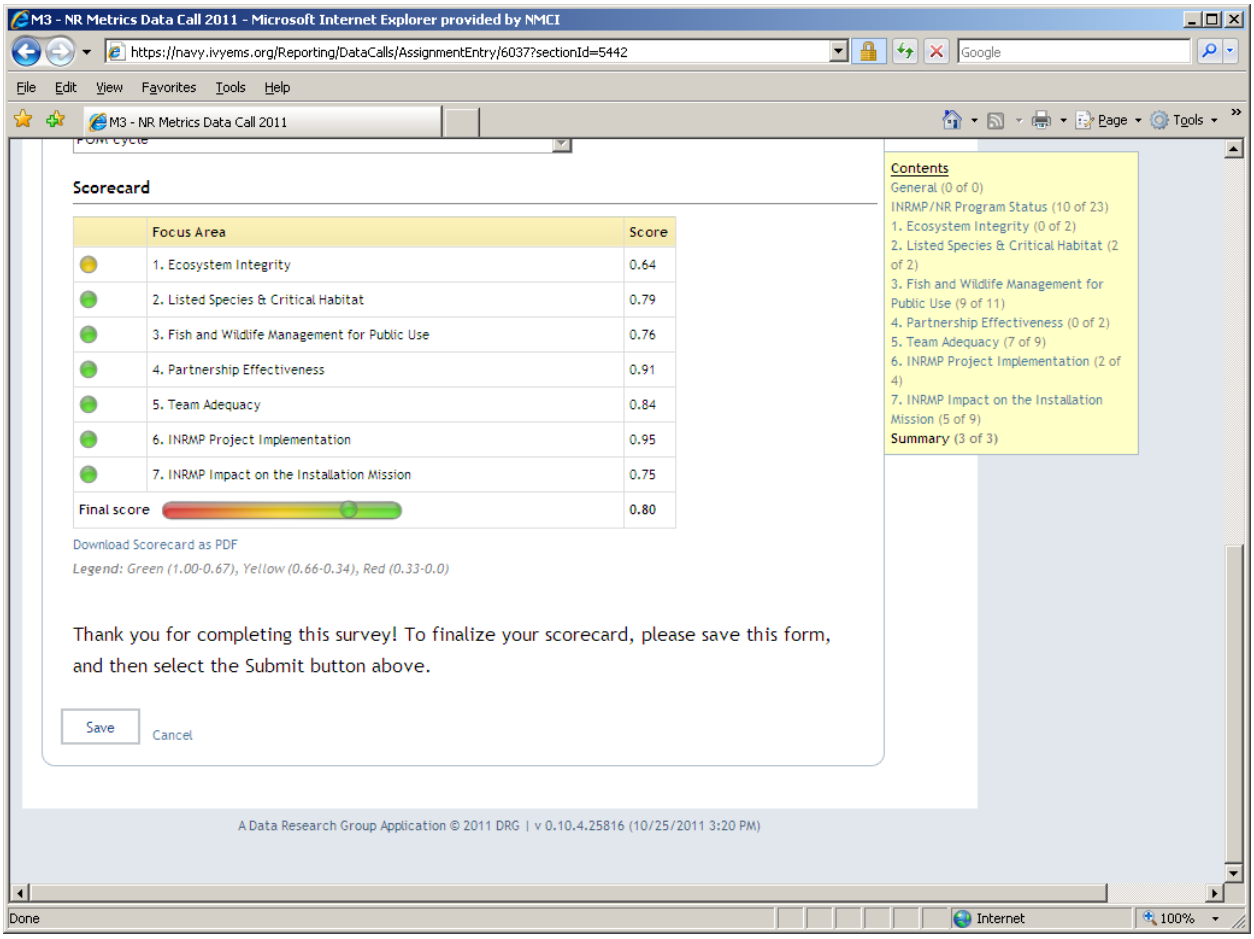

Figure 1. Example of NR Metrics Scorecard.

The questions asked in each Focus Area of the NR Metrics are intended to measure how well the Navy managed natural resources at each installation during any given year as well as the status of project implementation. In FY11, the Navy revised the questions to reflect the updated DoDI 4715.03 and draft OPNAVINST 5090, currently under revision. In addition, the field was asked to respond for all Navy-owned sites, which includes installations and special areas, in the Navy's real property database, iNFADS. Of the approximately 829 sites within iNFADS, 314 sites were found to have significant natural resources. These sites were then rolled up based on main installations, e.g. all special areas associated with an installation and covered under the same INRMP. Unique special areas having their own INRMP were counted separately. This list of sites was then correlated to the CNIC Base Command list.

Summary of NR Metrics by Focus Area

Per FY11 NR Metrics, many of the installations appear to have healthy NR programs (as indicated by the numerous green scores for the various Focus Areas), which reflects their ability to successfully implement projects identified in their existing INRMPS. Further, responses to questions in the Ecosystem Integrity and Listed Species & Critical Habitat Focus Areas indicate that existing INRMPs are sufficient in accomplishing ecosystem based management and protection of listed species. The questions *scored* in the NR Metrics that were used to evaluate

the health of the NR program and effectiveness of the INRMP at each installation are listed below by Focus Area.

Focus Area 1: Ecosystem Integrity –

According to the DoDI 4715.3, the goal of ecosystem management is to ensure that military lands support present and future training and testing requirements while preserving, improving, and enhancing ecosystem integrity. Over the long term, that approach shall maintain and improve the sustainability and biological diversity of terrestrial and aquatic (including marine) ecosystems while supporting sustainable economies, human use, and the environment required for realistic military training operations. This Focus Area is intended to define the ecosystems that occur on the installation and assess the integrity of these ecosystems. The term, integrity, refers to the quality of state of being complete, unbroken condition, wholeness, entirety, unimpaired, without significant damage, good condition, or general soundness. Terrestrial ecosystems, as defined by Nature Serve's "Ecological Systems of the United States: A Working Classification of US Terrestrial Systems" and marine ecosystems, as defined by NOAA's "Coastal and Marine Ecological Classification Standard" (including only the Benthic Biotic Component, Surface Geology Component, and Water Column Component of the classification scheme) were selected from a list and assigned to each installation. Locally-defined ecosystems were added, if necessary. Once the ecosystems were assigned to the installation, the following questions [4 out of 5 new in FY11] were asked for each of the ecosystems identified as being present on the installation.

1. To what extent is the ecological system on the installation fragmented due to land conversion? (0-5)

   Answers:
   0 = Ecosystem fragmentation is the result of five (5) of the phenomena (0)
   1 = Ecosystem fragmentation is the result of four (4) of the phenomena (0.20)
   2 = Ecosystem fragmentation is the result of three (3) of the phenomena (0.40)
   3 = Ecosystem fragmentation is the result of two (2) of the phenomena (0.60)
   4 = Ecosystem fragmentation is the result of one (1) of the phenomena (0.80)
   5 = No fragmentation (1.00)

2. Is the ecosystem effectively managed to sustain viable populations of species? (0-3)

   Answers:
   0 = Not effectively managed (0)
   1 = Minimally effective management (0.33)
   2 = Moderately effective management (0.67)
   3 = Effectively managed (1.00)

3. To what degree is the ecological system vulnerable to stressors? (0-5)

   Answers:
   0 = Completely Vulnerable (0)
   1 = Severely Vulnerable to Stress (0.20)
   2 = Highly Vulnerable to Stress (0.40)

3 = Moderately Vulnerable to Stress (0.60)
4 = Slightly Vulnerable to Stress (0.80)
5 = Not Vulnerable to Stress (1.00)

4. To what degree has the installation's INRMP/Natural Resources Program provided an overall benefit to ecological integrity? (0-3)

   Answers:
   0 = No Benefit (0)
   1 = Minor Benefit (0.33)
   2 = Moderate Benefit (0.67)
   3 = Significant Benefit (1.00)

Each of these questions in the Ecosystem Integrity Focus Area is equally weighted by a value of 1. This means that no one question contributes more to the overall score of the Focus Area than any other question. However, question #4 is the most relevant in terms of assessing the importance of the INRMP on Ecosystem Integrity. The score of each question, as well as the overall score of the Focus Area, can't exceed 1.00. This means that the score calculated for each question is the product of the numerical value associated with the answer provided and the weight (=1). For example, if the answer provided for question #4 is "No Benefit", then the score for that question is [0 x 1 = 0]. But, if the answer provided for question #4 is "Significant Benefit", then the score for that question is [1.00 x 1 = 1.00]. Therefore, if the INRMP has a significant benefit to ecological integrity, then the response of "Significant Benefit" to this question increases the potential for a higher overall score for this Focus Area, which may contribute to the Focus Area being coded as green.

Note: The numerical value associated with each answer is the result of the total potential score for the question (1.00) divided by the number of possible answers, except for zero. If NA is chosen, the question drops out of the calculation. For example, for question #4, there are three possible answers (other than "No Benefit", which is zero) so [1.00/3 = 0.33]. The answers are ranked according to importance, e.g. an INRMP with a "Significant Benefit" has more importance on the overall benefit to ecological integrity than an INRMP with a "minor benefit". Therefore, an answer of "Significant Benefit" to question #4 is weighted by 3, resulting in a score of 1.00 for the question.

Focus Area 2: Listed Species & Critical Habitat -

This Focus Area is intended to identify the federally listed species that occur on a Navy installation and/or special area, as well as determine if conservation efforts are effective and if the INRMP provides the conservation benefits necessary to preclude designation of critical habitat for particular species. Federally listed species were selected from the USFWS list of federally threatened and endangered species and assigned to each installation. Once the listed species were assigned to the installation, the following questions [1 out of 6 new in FY11] were asked for each of the federally listed species identified as being present on the installation.

1. To what extent do INRMP projects & programs provide a benefit to this species? (0-4, NA)

   Answers:
   0 = No benefit (0)
   1 = Minor benefits (0.25)
   2 = Moderate benefit (0.50)
   3 = Major benefit (0.75)
   4 = Significant benefit (1.00)
   NA

2. To what degree have projects been funded in support of this species? (0-4, NA)

   Answers:
   0 = No funding (0)
   1 = 1% to 25% funded (0.25)
   2 = 26% to 50% funded (0.50)
   3 = 51% to 75% funded (0.75)
   4 = 76% to100% funded (1.00)
   NA

3. To what extent are quantifiable goals, parameters, and monitoring requirements in place to assess conservation effectiveness? (0-4, NA)

   Answers:
   0= None (0)
   1= Minimal (0.25)
   2= Moderate (0.50)
   3= Good (0.75)
   4= Excellent (1.00)
   NA

4. Do existing surveys provide adequate data on habitat conditions? (Y/N)

   Answers:
   N (0)
   Y (1.00)

5. Do existing surveys provide adequate data on population presence and numbers? (Y/N)

   Answers:
   N (0)
   Y (1.00)

The questions in the Listed Species & Critical Habitat Focus Area are not equally weighted. Questions #1 and #3 are weighted the most at 1.1; question #2 is weighted 1.0; and questions #4 and #5 are weighted the least at 0.9. In particular, question #1 speaks directly to the effect of the INRMP on listed species. Therefore, if the answer provided for question #1 is "Significant Benefit", then the score for that question is [1.00 x 1.1 = 1.1]. Therefore, if the INRMP has a

significant conservation benefit to a listed species, then the response to this question increases the potential for a higher overall score for this Focus Area, which may contribute to the Focus Area being coded as green.

Focus Area 3: Fish and Wildlife Management for Public Use –

The purpose of this Focus Area is to evaluate the availability of public recreational opportunities, such as fishing and hunting, given the existing security requirements for the installation. While recreational opportunities may be available at an installation, they may be restricted for security reasons. The following questions [6 out of 9 new in FY11] were asked.

1. Are recreational opportunities available on the installation? (Y/N)

   Answers:
   N (0)
   Y (1.00)
   NA (landscape doesn't support recreational opportunities)

2. If recreational opportunities are available, are they limited/restricted for security reasons? (Y/N/NA)

   Answers:
   Y (0)
   N (1.00)
   NA (recreational opportunities are not available)

3. If recreational opportunities are available, are they offered to the public?

   Answers:
   N (0)
   Y (1.00)
   NA (recreational opportunities are not available)

4. If recreational opportunities are available, are they offered to DoD personnel?

   Answers:
   N (0)
   Y (1.00)
   NA (recreational opportunities are not available)

5. If recreational opportunities are available, are they accessible by disabled veterans/Americans?

   Answers:
   N (0)
   Y (1.00)

NA (recreational opportunities are not available)

6. Are Sikes Act fees collected for outdoor recreational opportunities? (Y/N/NA)

   Answers:
   N (0)
   Y (1.00)
   NA (recreational opportunities do not include hunting and fishing)

7. Is there an active natural resources law enforcement program on the installation? (Y/N/NA)

   Answers:
   N (0)
   Y (1.00)
   NA (recreational opportunities do not include hunting and fishing)

8. Are sustainable harvest goals addressed in the INRMP and effective for the management of the species' population? (0-4, NA)

   Answers:
   0 = Not effective (0)
   1 = Minimal effectiveness (0.25)
   2 = Moderate effectiveness (0.50)
   3= Effective (0.75)
   4 = Highly effective (1.00)
   NA (recreational opportunities do not include hunting and fishing)

9. Is public outreach/educational awareness provided? (0-4, NA)

   Answers:
   0 = No public outreach provided (0)
   1 = Low outreach (0.25)
   2 = Moderate outreach (0.50)
   3 = Good outreach (0.75)
   4 = Excellent outreach (1.00)
   NA

The questions in the Fish and Wildlife Management for Public Use Focus Area are not equally weighted. Question #1 is weighted the most at 1.2; questions #2-5, #8, and #9 are weighted 1.0; and questions #6 and #7 are weighted the least at 0.9. Overall the questions in this Focus Area are relatively evenly weighted due to the fact that there are many contributing factors to whether or not recreational opportunities are available at an installation. Specifically, security restrictions often limit access to recreational opportunities. However, question #1 speaks to whether recreational opportunities are available on the installation. Therefore, if the answer provided for question #1 is "Yes", then the score for that question is [1.00 x 1.2 = 1.2]. Therefore, if the installation offers recreational opportunities, as prescribed by the Sikes Act, then the response to this question increases the potential for a higher overall score for this Focus Area, which may

contribute to the Focus Area being coded as green. Similarly, question #2 asks if available recreational opportunities are limited or restricted for security reasons. Therefore, if the answer provide for question #2 is "Yes", then the score for that question is [0 x 1 = 0]. This will reduce the overall score for this Focus Area, which may contribute to the Focus Area being coded yellow or red.

Focus Area 4: Partnership Effectiveness –

The purpose of this Focus Area is to determine to what degree partnerships are cooperative and result in effective implementation of the INRMP. Partnerships and/or initiatives actively participated in by installation NR staff were identified. Once they were identified, the following questions [4 out 10 new in FY11] were asked for each of the partnerships and/or initiatives identified as relevant to the installation.

1. Does your Natural Resources program support the regional conservation efforts of the USFWS? (Y/N)

   Answers:
   N (0)
   Y (1.00)

2. Does your Natural Resources program support State conservation goals identified in State Wildlife Action Plans (SWAPs)? (Y/N)

   Answers:
   N (0)
   Y (1.00)

3. Does your Natural Resources program support regional NOAA/NMFS conservation objectives/efforts? (Y/N/NA)

   Answers:
   N (0)
   Y (1.00)
   NA

4. Does your Natural Resources program support other Conservation Initiatives? (Y/N)

   Answers:
   N (0)
   Y (1.00)

5. Is there adequate collaboration/cooperation between partners? (0-4)

   Answers:
   0 = None (0)
   1 = Minimal cooperation (0.25)
   2 = Satisfactory cooperation (0.50)
   3 = Effective cooperation (0.75)
   4 = Highly effective cooperative (1.00)

6. Are NR program executions meeting USFWS & State expectations? (0-4)

   Answers:
   0 = Dissatisfied (0)
   1 = Minimally satisfied (0.25)
   2 = Somewhat satisfied (0.50)
   3 = Completely satisfied (0.75)
   4 = More than satisfied (1.00)

7. Did the USFWS participate in the INRMP/Natural Resources Program annual review? (Y/N)

   Answers:
   N (0)
   Y (1.00)

8. Did the State participate in the INRMP/Natural Resources Program annual review? (Y/N)

   Answers:
   N (0)
   Y (1.00)

9. Did the NOAA/NMFS participate in the INRMP/Natural Resources Program annual review, if applicable? (Y/N/NA)

   Answers:
   N (0)
   Y (1.00)
   NA

10. To what extent has the INRMP/Natural Resources Program successfully supported other mission areas? (e.g. encroachment, BASH, range support, port operations, air operations, facilities management, etc.) (0-4)

    Answers:
    0 = Not supported (0)
    1 = Minimally supported (0.25)
    2 = Satisfactorily supported (0.50)

3 = Well supported (0.75)
4 = Very well supported (1.00)

The questions in the Partnership Effectiveness Focus Area are not equally weighted. Questions #5 and #7-9 are weighted the most at 1.1; questions #1-3 and #6 are weighted 1.0; and questions #4 and #10 are weighted the least at 0.8. In particular, questions #7-9 speak directly to stakeholder participation in the annual Sikes Act review of the INRMP and NR Program at each of the installations. Specifically, question #7 asks if the USFWS participated in the INRMP/Natural Resources Program annual review. Therefore, if the answer provided for question #7 is "Yes", then the score for that question is [1.00 x 1.1 = 1.1]. Likewise, if the answers to question #8 (regarding State Fish and Wildlife agency participation in the review) is "Yes" and question #9 (regarding NOAA/NMFS participation in the review, when applicable) is "Yes", then the score for each of these questions is [1.00 x 1.1 = 1.1]. Therefore, if our Sikes Act partners are actively engaged in the annual review of our INRMPs, then the response to these questions increases the potential for a higher overall score for this Focus Area, which may contribute to the Focus Area being coded as green.

Focus Area 5: Team Adequacy –

The purpose of this Focus Area is to assess the effectiveness and adequacy of the Navy natural resources team in accomplishing the goals and objectives of the INRMP and Natural Resources Program at each installation. Team refers to the Navy staff only. The following questions [1out of 7 new in FY11] were asked.

1. Is there a Navy professional Natural Resources Manager assigned by the Installation Commanding Officer? (Y/N)

   Answers:
   N (0)
   Y (1.00)

2. Is there an on-site Navy professional Natural Resources Manager? (Y/N)

   Answers:
   N (0)
   Y (1.00)

3. Is HQ and Regional support adequate, e.g. reach back support for execution, policy support, etc.)? (0-4)

   Answers:
   0 = No support (0)
   1 = Minimal support (0.25)
   2 = Satisfactory support (0.50)
   3 = Well supported (0.75)
   4 = Very well supported (1.00)

4. Is there adequate Natural Resources staff to properly implement the INRMP goals and objectives? (Y/N)

   Answers:
   N (0)
   Y (1.00)

5. The team is enhanced by the use of contractors. (0-4)

   Answers:
   0 = Disagree (0)
   1 = Somewhat agree (0.25)
   2 = Neutral (0.50)
   3 = Agree (0.75)
   4 = Strongly Agree (1.00)

6. The team is enhanced by the use of volunteers. (0-4, NA)

   Answers:
   0 = Disagree (0)
   1 = Somewhat agree (0.25)
   2 = Neutral (0.50)
   3 = Agree (0.75)
   4 = Strongly Agree (1.00)
   NA

7. The Natural Resources team is adequately trained to accomplish its duties to ensure compliance. (0-4)

   Answers:
   0 = Disagree (0)
   1 = Somewhat agree (0.25)
   2 = Neutral (0.50)
   3 = Agree (0.75)
   4 = Strongly Agree (1.00)

The questions in the Team Adequacy Focus Area are not equally weighted by a value of 1. Questions #4 and #7 are weighted the most at 1.1; questions #1-3 are weighted 1.0; and questions # and #6 are weighted the least at 0.9. In particular, questions #4 and #7 speak directly to having sufficient NR staff and adequately trained NR staff to properly implement the INRMP goals and objectives at each of the installations. Therefore, if the answers to question #4 (regarding sufficient NR staff) is "Yes" and question #7 (regarding adequately trained NR staff) is "Yes", then the score for each of these questions is [1.00 x 1.1 = 1.1]. Therefore, the likelihood of getting a higher overall score for this Focus Area increases if there is sufficient NR staff that is adequately trained at the installation, which may contribute to the Focus Area being coded as green.

Focus Area 6: INRMP Project Implementation –

The purpose of this Focus Area is to assess how the goals and objectives of the INRMP have been met through the projects implemented during the previous fiscal year. Projects were selected from a list of EPRWeb projects and evaluated based on the type of funding received, the status of the project, and whether projects realized their intended goals. In addition, benefits to ecosystem integrity or a listed species, previously identified as a part of the installation, were noted for each project, if applicable. The following questions [9 out of 10 new in FY11] were asked for each project identified as being implemented during FY11 at each installation.

1. Is project accomplishment on schedule? (Y/N)

   Answers:
   N (0)
   Y (1.00)

2. What is the Project Status? (0,1)

   Answers:
   0= On-Hold; Funds Not Yet Received (0)
   1= In EPRWeb; In POM; Emergent; Funding Received; SOW Prepared; Awarded/Executed; Now In-Progress; Completed (1.00)

3. Which Natural Resources Program Area was most benefitted from the project? (0,1)

   Answers:
   0=None (0)
   1= Flora; Fauna; Habitat; At Sea; INRMP; Listed Species; Wetlands; Invasives; Soil; Forestry; Outdoor Recreation; Training; Other NR Requirements (Misc) (1.00)

4. The project design met the goals and objectives of the INRMP. (0-4)

   Answers:
   0 = Disagree (0)
   1 = Neither agree nor disagree (0.25)
   2 = Somewhat Agree (0.50)
   3 = Fully Agree (0.75)
   4 = Strongly Agree (1.00)

The questions in the INRMP Project Implementation Focus Area are equally weighted by a value of 1. In general, these questions are intended to evaluate the status of INRMP project implementation. Because there are some many factors outside the control of the NR program manager, it is difficult to score this Focus Area. It wouldn't be fair to penalize the NR program manager because many times the implementation status is due to a lack of funding or delays in execution. As long as the NR program manager has done their part in getting projects POMed and designed to meet the goals and objectives of the INRMP, then this should be reflected in the

score for this Focus Area. For example, if the answer to question #2 (regarding status of the project) is "In EPRWeb; In POM; Emergent; Funding Received; SOW Prepared; Awarded/Executed; Now In-Progress; or Completed" and question #4 (regarding project design) is "Strongly Agree", then the score for each of these questions is [1.00 x 1 = 1.00]. Therefore, the likelihood of getting a higher overall score for this Focus Area increases, which may contribute to the Focus Area being coded as green.

Focus Area 7: INRMP Impact on Installation Mission –

This Focus Area is designed to measure the level to which existing natural resource compliance requirements and associated actions support the installation's ability to sustain the current operational mission. Per the Sikes Act, the goals and objectives of an INRMP should achieve no net loss of the mission at an installation. The following questions [0 are new in FY11] were asked.

1. Has Coordination between natural resources staff and other installation departments and military staff been successful/effective? (0-4)

   Answers:
   0 = No coordination (0)
   1 = Minimal coordination (0.25)
   2 = Satisfactory coordination (0.50)
   3 = Effective coordination (0.75)
   4 = Highly effective coordination (1.00)

2. To what extent has the INRMP successfully supported other mission areas? (e.g. encroachment, BASH, range support, port operations, air operations, facilities management, etc.) (0-4)

   Answers:
   0 = Not supported (0)
   1 = Minimally supported (0.25)
   2 = Satisfactorily supported (0.50)
   3 = Well supported (0.75)
   4 = Very well supported (1.00)

3. To what extent has there been a net loss of training lands or mission-related operational/training activities? (0-4)

   Answers:
   0 = Mission is fully impeded; training activities cannot be conducted (0)
   1 = Mission/Training activities are somewhat impeded with workarounds (0.25)
   2 = Neutral (0.50)
   3 = No loss occurred (0.75)
   4 = Mission has seen benefits (1.00)

4. Does the Natural Resource program effectively consider current mission requirements? (0-4)

   Answers:
   0: Strongly disagree
   1: Disagree
   2: Neutral
   3: Agree
   4: Strongly Agree

The questions in the INRMP Impact on Installation Mission Focus Area are equally weighted by a value of 1. In general, these questions are intended to evaluate the effectiveness of the installation's NR program on mitigating and/or avoiding natural resource impacts on the installation's military mission. For example, if the answer to question #3 is "Mission has seen benefits, then the score for this question is [0.75 x 1 = 0.75]. Therefore, the INRMP satisfies a fundamental requirement of the Sikes Act, no net loss of the mission, contributing to a higher overall score for this Focus Area, which may contribute to the Focus Area being coded as green.

Summary of INRMP and Sikes Act Questions

In addition to the NR Metrics questions, some additional questions were asked to assess the status of INRMPs at installations. In general, if an installation is reported as having significant natural resources, then it was counted as an installation requiring an INRMP. Per the DoDI 4715.03, significant natural resources are defined as resources identified as having special importance to an installation and/or its ecosystem. Natural resources may be significant on a local, regional, national, or international scale. All threatened, endangered and at-risk species are significant natural resources that normally require an INRMP. Installations that actively manage fish and wildlife, forestry, vegetation and erosion control, agricultural outleasing or grazing, or wetlands protection should be evaluated for significance, but normally will require an INRMP. An evaluation for significance should also consider the degree of active management, special natural features, aesthetics, outdoor recreational opportunities, and the ecological context of the installation. There are 73 Navy installations requiring INRMPs, all of which currently have an INRMP.

However, not all Navy installations with an INRMP have a compliant INRMP. A compliant INRMP is defined as "a complete plan that meets the purposes of the Sikes Act (§101(a)(3)(A-C)), contains the required plan elements (§101(b)(1)(A-J)), and has been reviewed for operation and effect within the past 5 years (§101(2)(b)(2))." Therefore, a compliant INRMP must be Sikes Act compliant and less than 5 years old. If the INRMP is greater than 5 years old, then it must have undergone a review for operation and effect within the past 5 years. A review for operation and effect is defined as "a comprehensive review by the Parties, at least once every 5 years, to evaluate the extent to which the goals and objectives of the INRMP continue to meet the purpose of the Sikes Act, which is to carry out a program that provides for the conservation and rehabilitation of natural resources on military installations. The outcome of this review will assist in determining if the INRMP requires a revision (§101(f)(1)(A)). (CNO-N45) The annual review can qualify for the 5-year review for operation and effect, which is legally required by the Sikes Act, if mutually agreed upon by both partners (i.e. USFWS and State)." According to this

definition, there are 41 compliant INRMPs and 32 noncompliant INRMPs. But, if you qualify the annual review of the Natural Resource Program/INRMP with the USFWS and State Fish and Wildlife agencies as a sufficient review for operation and effect, then the total number of noncompliant INRMPs decreases to only 4. Therefore, the remaining 28 INRMPs could be considered partially compliant because they meet the condition of a noncompliant INRMP, but the USFWS participated in the annual NR Metrics review during the last reporting period (FY11).

INRMP implementation refers to projects that meet the goals and objectives of the INRMP. In FY11, total funds expensed toward implementing all 73 INRMPs equal $29,475,223. These funds include O&MN, MIS, Ag-Outlease, Forestry Reserve Account, Legacy, and Special Projects funds. Of this, $4,502,462 was spent on federally listed species, which accounts for approximately 15% of the total INRMP implementation costs. There are 75 critical habitat designations across all Navy installations, with 37 of these granted critical habitat designation exclusion under the ESA (Sec. 4. (a)), per NDA 2004. Further, 31 of those critical habitat designation exclusions were granted due to an INRMP.

Further Consideration

Given the results of the FY11 NR Metrics, it appears that there may be a discrepancy between the health of the NR programs across the Navy and the POM-14 budget request. It is important to consider that the NR Metrics were designed to be subjective. So, it is difficult to try and interpret the answers provided to the NR Metrics in a way that will help justify something objective, like the budget. The two are not directly correlated. The POM-14 budget request is forward looking, e.g. what is needed to execute projects associated with INRMPs in the out-years. On the other hand, the NR Metrics reflect the past execution and implementation of INRMPs.

However, the increased request for funds may reflect the fact that many of the INRMPs need to be revised. According to this year's DEPARC data, there are 28 partially compliant INRMPs and 4 noncompliant INRMPs. Many of these may require a revision. There are likely many new projects associated with these noncompliant and partially compliant INRMPs that need to be implemented; hence, the increased request for funds.

Therefore, INRMP project tables should really be compared to projects in POM-14. This will highlight if there are still projects in INRMPs that need to be implemented, hence the INRMPs are not being successfully implemented and the goals and objectives of the INRMP may not be met. In the future, consideration should be given to framing questions in the INRMP Project Implementation Focus Area in a manner that asks about INRMP Implementation tables, instead of EPR Execution Reports. If the objective is to evaluate how well the current INRMP is being implemented and meeting the goals of the NR Program, then this is what should be driving requests for funds. The annual funds expensed will continue to be pulled from the EPR Execution Report.

Appendix T: Public Comments

No comments were received during the public comment period for this document.

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