United States Department of the Interior

BUREAU OF LAND MANAGEMENT

Nevada State Office
P.O. Box 12000 (1340 Financial Blvd.)
Reno, Nevada 89520-0006
http://www.nv.blm.gov

In Reply Refer To:
1610 (LVFO)
(NV-930.1)
(NV-050)

September 17, 2001

Dear Reader:

Enclosed for your review and comments are the Draft Nevada Test and Training Range Resource Management Plan and Draft Environmental Impact Statement (DEIS) for the management of approximately 2 million acres. This Plan is a revision of the existing Nellis Air Force Range Resource Plan and Environmental Impact Statement. It was specifically directed by a provision in P.L. 106-65. This Plan takes a hard look at management options for wild horses on lands which were withdrawn for military purposes.

Your review and comments are needed at this time to ensure that any concerns will be considered in this planning process. Please direct written comments to Jeffrey G. Steinmetz, Team Leader, Bureau of Land Management, Las Vegas Field Office, 4765 West Vegas Drive, Las Vegas, Nevada 89108. To ensure prompt review and consideration of your comments, please note on the envelope, "Draft RMP Comments Enclosed." Due to the fact that the Las Vegas Field Office will be relocating during the 90-day comment period, it is advised that you write or call the Las Vegas Field Office at (702) 647-5000 for the new address. The move is expected to be completed by the end of November 2001. At this time the new address and new telephone prefix are not available. Written comments can be submitted, in full, at any of the public meetings.

Oral comments can be expressed at the following public meetings:

Tuesday, November 27, 2001, Pahrump, Bob Rudd Community Center, 150 N. Highway 160
Thursday, November 29, 2001, Beatty, Beatty Community Center 100 A Avenue South
Tuesday, December 4, 2001, Alamo, New High School Multi-Purpose Room 151 S. Main
Thursday, December 6, 2001, BLM Las Vegas Field Office, 4765 West Vegas Drive

All meetings will begin at 7:00 p.m. and end on or near 9:00 p.m. A time limit may be placed on oral comments, depending on the number of people who wish to make a statement. Oral comments should be accompanied by a written synopsis of the presentation. Written and oral comments will be fully considered and evaluated in preparation of the Proposed Nevada Test and Training Range and Final Environmental Impact Statement.

Written comments must be postmarked or otherwise delivered by 4:15 p.m., 90 days following the date the Environmental Protection Agency (EPA) publishes a Notice of Availability and filing of the Draft EIS in the Federal Register. The EPA Notice of Availability is expected to be published on or about September 17, 2001.

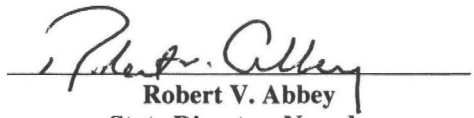
Sincerely,

Robert V. Abbey
State Director, Nevada

DRAFT

NEVADA TEXT AND TRAINING RANGE RESOURCE MANAGEMENT PLAN AND ENVIRONMENTAL IMPACT STATEMENT

Prepared by:
UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
LAS VEGAS FIELD OFFICE



Robert V. Abbey
State Director, Nevada

This Draft Nevada Test and Training Range Resource Management Plan and Environmental Impact Statement is the first step in developing a management plan to guide applicable BLM policy and decisions over the next 20 years on approximately 2 million acres of BLM land withdrawn for military purposes. The plan describes and analyzes the options for management of natural resources of the withdrawn public lands in Clark, Nye and Lincoln counties, Nevada. Due to the nature of this withdrawal some resources uses are either restricted or controlled. For example, the entire withdrawn area is closed to casual use by recreationists.

For further information contact: Jeffrey G. Steinmetz, Bureau of Land Management, Las Vegas Field Office, 4765 West Vegas Drive, Las Vegas, Nevada, or call 702-647-5097. Please be advised the telephone prefix number 647 and the address will change when the Las Vegas Field Office relocates. At publication time the prefix and address are not known.

Please submit written comments to Jeffrey G. Steinmetz at the address noted above. The comment due date will be based on the publication of the Environmental Protection Agency Federal Register Notice of Availability, which is expected to be around September 17, 2001.

DRAFT
NEVADA TEST & TRAINING RANGE
RESOURCE MANAGEMENT PLAN AND ENVIRONMENTAL IMPACT STATEMENT

SUMMARY

This Resource Management Plan (RMP) identifies the resources to be managed on the Nevada Test and Training Range (NTTR), the level of protection they are to be provided, and what use of resources is appropriate on an area withdrawn for the specific mission of training pilots for combat readiness. Basic restrictions are necessary to fulfill this mission and are stated in the body of this analysis.

The NTTR (formerly known as the Nellis Air Force Range, (NAFR)) military withdrawal area comprises approximately 3 million acres. It is a complex assembly of lands managed or regulated by numerous agencies, federal, state and local. The U. S. Bureau of Land Management (BLM), U. S. Fish and Wildlife Service (USFWS), U. S. Air Force, U. S. National Nuclear Security Administration (NNSA), U. S. Environmental Protection Agency (EPA), Nevada Division of Wildlife (NDOW), Nevada Division of Environmental Protection (NDEP), Nye County, Lincoln County, Clark County Health District, Clark County Comprehensive Planning and Clark County Regional Transportation Commission all have responsibilities to public resource management or public health and safety on the NTTR. Administratively the NTTR is divided into a North Range and a South Range component, which are largely separated by the NNSA's Nevada Test Site (NTS). The North Range contains the BLM's Nevada Wild Horse Range (NWHR), and the Department of Energy's (DOE) Tonopah Test Range (TTR). Most of the South Range was withdrawn by Congress for the joint uses of the USFWS as the Desert National Wildlife Range (DNWR) and the Air Force. The planning area described in this RMP includes only those public lands in Nevada withdrawn from multiple use under BLM management by P.L. 106-65. This plan does not cover any lands within the P.L.106-65 withdrawal that are administered by the USFWS as part of the DNWR.

The NTTR is considered the best training facility of its kind in the world. Air crews from throughout the world come to this site for quality training almost year round. Public Law 106-65, approved October 5, 1999, renewed the withdrawal for a period of 20 years. The following excerpts from the law provide directions for the management of the public lands withdrawn from multiple use status.

In summary, Section 3014 of PL 106-65 identifies management of lands as follows:
"The Secretary of the Interior shall manage the lands withdrawn pursuant to the Federal Land Policy and Management Act of 1976, other applicable law, and this subtitle."

In accordance with the above, the Secretary of Interior, after consultation with the Secretary of the Military department concerned, shall develop a plan for management of each area. Each plan shall–

(A) be consistent with applicable law;
(B) be subject to the conditions and restrictions specified in PL 106-65;
(C) include such provisions as may be necessary for proper management and protection of resources and values of such area; and
(D) be developed not later than two years after the date of enactment of this act 10/5/1999.

Four alternatives (A, B, C, and D), including "No Action" (Alternative A) are presented. The

objectives and management directions for Alternatives A and B are presented in the same sequence that the relevant resources and programs are addressed in the discussion of the affected environment. All objectives in Alternative B, other than those related to wild horses, apply to Alternatives C and D. Objectives and management direction for Alternatives C and D are presented only for wild horses, which would be managed differently from Alterative B.

Since the NTTR is not open to public access and is, in essence, a protected area, the planning team did not see a need to prescribe different management under each alternative for each resource, other than wild horses.

The fact that the alternatives are essentially the same for all resources and programs other than wild horses is a function of the purposes of the withdrawal. The BLM has little leeway on how different resources are to be managed within the withdrawn lands. Air Force requirements include operational areas, target arrays, plus critical safety and security provisions. Maintaining the wild horse herds must be compatible and supportive of the mission operations, the safety of the range staff, and allowing the Air Force to provide necessary security.

The No-Action alternative (Alternative A) represents the management objectives and directions contained in the approved BLM 1992 Nellis Air Force Range Resource Management Plan including those changes that have occurred since 1992. This alternative is the basis for comparison between the other alternatives. The objectives, management directions and management actions of the existing RMP that have been, or have not been, implemented are presented. No new management is proposed in this alternative.

Alternative B addresses the full spectrum of resources to be managed in the planning area. It provides for habitat improvements, control/eradication of weeds and noxious plant species, protection of sensitive plant and animal species, protection and enhancement of riparian zones, management of vegetation resources through prescribed burns, livestock grazing management, and cultural resources management. Importantly, it also represents an interpretation of available data to identify the area for management of the wild horses on the NTTR. Wild horse management on the NTTR is one of the most important resource management issues.

This alternative (B) identifies a wild horse herd area (HA) consistent with data that suggest wild horses used much of the North Range in 1971. This entire 1971 herd area is identified as the herd management area (HMA). A smaller portion of this HMA is identified within which the appropriate management level (AML) of horses would be calculated. This alternative allows for drift of horses seasonally from the AML core, and focuses on the removal of any wild horses that establish a permanent home range outside the core area used to determine AML. With built-in safeguards for habitat improvement, the impacts of horse grazing would be monitored closely with adjustments made in the number of horses based on habitat conditions.

Other than for wild horses, all resource management objectives in Alternative C are the same as those for Alternative B. With respect to wild horses, Alternative C represents the area where the Air Force believes wild horses should be managed to minimize conflicts with the Air Force mission. The proposed HMA is a subset of the approximate 1971 HA. This proposed HMA encompasses an area of 325,220 acres. Horses would be allowed to move outside the HMA provided they did not establish permanent home ranges outside of the HMA. The Air Force would be able to request BLM to remove horses outside the HMA, and a typical reason for such a request would be the home range issue.

As with Alternative C, other than for wild horses, all resource management objectives in Alternative D are the same as those for Alternative B. Alternative D identifies complete removal of

wild horses. Several reasons for removal could relate to AML, water quantity, or water quality. Also, it is possible that management of the wild horses could be changed because of new Air Force mission requirements. An alternative to assess these possibilities is appropriate.

Alternatives A and B are discussed for most resources on the NTTR. Alternatives B, C and D are very similar for the majority of the resources, except for management of wild horses. The analysis focuses on the difference in impacts for each alternative. Where the impacts are the same for each alternative, that is stated as appropriate.

A key in reviewing this analysis is the programmatic nature of this document. Impacts are analyzed in a general manner primarily by the fact that the majority of the actions/activities that the BLM manages are not dealt with on a site-specific basis. Site-specific analysis will be undertaken during implementation of the objectives and management directions in the approved plan.

THIS PAGE DELIBERATELY LEFT BLANK

TABLE OF CONTENTS

CHAPTER 2

ALTERNATIVES

CHAPTER 3

DESCRIPTION OF THE AFFECTED ENVIRONMENT

CHAPTER 4

ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE ACTIONS

CHAPTER 5

CONSULTATION AND COORDINATION

CHAPTER 6

PLAN IMPLEMENTATION, MAINTENANCE, AND AMENDMENT

CHAPTER 7

APPENDICES

LIST OF FIGURES

LIST OF TABLES

APPENDIX A

APPENDIX B

APPENDIX C

APPENDIX D

APPENDIX E

ACRONYMS

ACEC	Area Critical Environmental Concern
ADC	Animal Damage Control Plan
AEC	U. S. Atomic Energy Commission
AML	appropriate management level
AMS	Analysis of the Management Situation
AUM	animal unit months
BLM	Bureau of Land Management
CBUs	cluster bomb units
CCHD	Clark County Health District
CFR	Code of Federal Regulations
CO	carbon monoxide
CRMP	Cultural Resources Management Plan
DNWR	Desert National Wildlife Range
DOE	U. S. Department of Energy
DRMO	Defense Reutilization and Marketing Office
EA	Environmental Assessment
ECM	electronic countermeasure
EIS	Environmental Impact Statement
EPA	U. S. Environmental Protection Agency
ESA	Endangered Species Act of 1973 , Public Law 93-205
ESI	Ecological Status Inventory
FEMA	Federal Emergency Management Agency
FLPMA	Federal Land Policy and Management Act of 1976
FONSI	Finding of No Significant Impact
GIS	Geographic Information System
HA	herd area
HEP	Habitat Evaluation Procedures
HMA	herd management area
HMAP	Herd Management Area Plan
ICRMP	Integrated Cultural Resource Management Plan
IRMP	Integrated Resource Management Plan
ISAFAF	Indian Springs Air Force Auxiliary Air Field
LEIS	Legislative Environmental Impact Statement
MAJCOM	major command
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NAFB	Nellis Air Force Base
NAFR	Nellis Air Force Range
NAFRRP	Nellis Air Force Range Resource Management Plan
NAGPRA	Native American Graves, Protection and Repatriation Act
NBMG	Nevada Bureau of Mines and Geology
NDEP	Nevada Division of Environmental Protection

NDOW	Nevada Division of Wildlife
NEPA	National Environmental Policy Act
NHLP	National Historic Landmarks Program
NHPA	National Historic Preservation Act
NNSA	U. S. National Nuclear Security Administration
NOA	Notice of Availability
NOAA	National Oceanic and Atmospheric Agency
NOI	Notice of Intent
NRCS	Natural Resources and Conservation Service, USDA
NRHP	National Register of Historic Places
NTS	Nevada Test Site
NTTR	Nevada Test and Training Range
NWHR	Nevada Wild Horse Range
PAHs	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyl
PFC	Proper Functioning Condition
PJ	pinyon-juniper
PM10	Dust particles smaller with a diameter less than 10 microns
PRGs	Preliminary Remediation Goals
RMP	Resource Management Plan
ROW	rights-of-way
SHPO	State Historic Preservation Officer
SOC	Species of Concern
SVOCs	semi-volatile organic compounds
TMDL	Total Maximum Daily Load
TPECR	Tolicha Peak Electronic Combat Range
TTR	Tonopah Test Range
URTD	upper respiratory tract disease
USAF	U. S. Air Force
USBM	U.S. Bureau of Mines
USDA	U.S. Department of Agriculture
USDI	U. S. Department of Interior
USFWS	U. S. Fish and Wildlife Service
VRM	visual resource management
WHBA	Wild Free-Roaming Horse and Burro Act of 1971, Public Law 92-195
WSA	wilderness study area

CHAPTER 1
INTRODUCTION

1.1 PURPOSE AND NEED

This Resource Management Plan (RMP) identifies the resources to be managed on the Nevada Test and Training Range (NTTR), the level of protection they are to be provided, and what use of resources is appropriate on an area withdrawn for the specific mission of training pilots for combat readiness. Basic restrictions are necessary to fulfill this mission and are stated in the body of this analysis.

1.2 DESCRIPTION OF THE PLANNING AREA

The NTTR (formerly known as the Nellis Air Force Range, (NAFR)) military withdrawal area comprises approximately 3 million acres. It is a complex assembly of lands managed or regulated by numerous agencies, federal, state and local. The U. S. Bureau of Land Management (BLM), U. S. Fish and Wildlife Service (USFWS), U. S. Air Force, U. S. National Nuclear Security Administration (NNSA), U. S. Environmental Protection Agency (EPA), Nevada Division of Wildlife (NDOW), Nevada Division of Environmental Protection (NDEP), Nye County, Lincoln County, Clark County Health District, Clark County Comprehensive Planning and Clark County Regional Transportation Commission all have responsibilities to public resource management or public health and safety on the NTTR. Administratively the NTTR is divided into a North Range and a South Range component, which are largely separated by the NNSA's Nevada Test Site (NTS). The North Range contains the BLM's Nevada Wild Horse Range (NWHR), and the Department of Energy's (DOE) Tonopah Test Range (TTR). Most of the South Range was withdrawn by Congress for the joint uses of the USFWS as the Desert National Wildlife Range (DNWR) and the Air Force. The planning area described in this RMP, and shown in Figure 1-1, includes only those public lands in Nevada withdrawn from multiple use under BLM management by P.L. 106-65. The legal description for this planning area is presented in Appendix A. This plan does not cover any lands within the P.L.106-65 withdrawal that are administered by the USFWS as part of the DNWR.

1.3 PUBLIC LAW 106-65 REQUIREMENTS

The NTTR is considered the best training facility of its kind in the world. Air crews from throughout the world come to this site for quality training almost year round. Public Law 106-65, approved October 5, 1999, renewed the withdrawal for a period of 20 years. The following excerpts from the law provide directions for the management of the public lands withdrawn from multiple use status.

In summary, Section 3014 of PL 106-65 identifies management of lands as follows:

"The Secretary of the Interior shall manage the lands withdrawn pursuant to the Federal Land Policy and Management Act of 1976, other applicable law, and this subtitle."

Activities Authorized - To the extent consistent with applicable law and Executive orders, the lands withdrawn may be managed in a manner permitting -

(A) the continuation of grazing where permitted on the date of the enactment of this Act;
(B) the protection of wildlife and wildlife habitat;
(C) the control of predatory and other animals;
(D) recreation; and
(E) the prevention and appropriate suppression of brush/range fires resulting from nonmilitary activities.

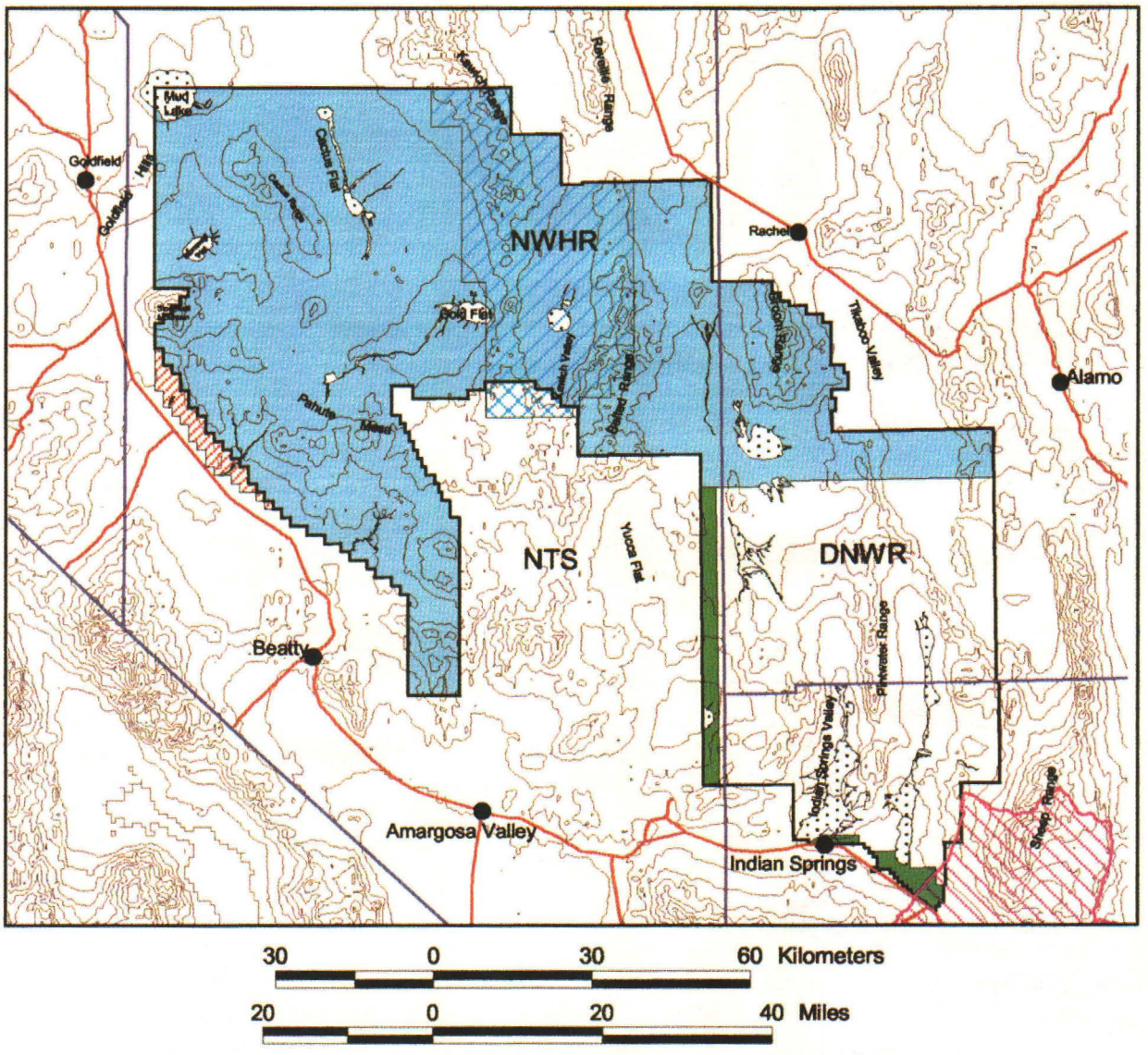


Figure 1-1. Nevada Test and Training Range. Areas on the NTTR that overlap the Desert National Wildlife Range (DNWR) are not part of the planning area.

Nonmilitary uses - "shall be subject to such conditions and restrictions as may be necessary to permit the military use of such lands for the purposes specified in or authorized pursuant to this subtitle. The Secretary of the Interior may issue a lease, easement, right-of-way, or other authorization with respect to nonmilitary use of the lands, only with the concurrence of the Secretary of the Military department concerned."

Closure to the Public - "If the Secretary of the Military department concerned determines that military operations, public safety, or national security require closure to public use of any road, trail, or other portion of lands withdrawn, that Secretary may take such actions as that Secretary determines necessary or desirable to effect and maintain such closure"

Management Plans- The Secretary of Interior, after consultation with the Secretary of the Military department concerned, shall develop a plan for management of each area. Each plan shall–

(A) be consistent with applicable law;

(B) be subject to the conditions and restrictions specified in PL 106-65;

(C) include such provisions as may be necessary for proper management and protection of resources and values of such area; and

(D) be developed not later than two years after the date of enactment of this act 10/5/1999.

Brush and Range Fires- The Secretary of the military department concerned shall take necessary precautions to prevent and suppress brush and range fires occurring within and outside the withdrawn lands as a result of military activities and may seek assistance from the BLM in suppression of such fires.

1.4 JURISDICTION UNDER THE CLEAN AIR ACT

The Clark County Health District (CCHD) has jurisdiction because a small part of the south planning area is located in the Clark County non-attainment area for PM 10 and carbon monoxide (CO). The CCHD has the regulatory authority to enforce the Clean Air Act and may require application of specific Best Management Practices on withdrawn lands in the non-attainment area to ensure compliance with the new regulations that took effect on January 1, 2001.

1.5 RANGE OF ALTERNATIVES

The Draft NTTR RMP analyzes four alternatives. The alternatives respond to specific issues identified by the public during the initial scoping process and meet the requirements of the BLM Land Use Planning Handbook H-1601-1. No single alternative satisfies all of the concerns expressed, but the concerns are addressed in various ways in the four alternatives. Most of the management objectives and management directions for each resource in each alternative are the same or very similar. This occurs, in part, because the withdrawal emphasizes the military training and testing mission, which limits resource management options.

The alternatives were prepared within the constraint that each alternative must be legally defensible and technically possible. The alternatives present a balance between legal requirements to provide an area for national defense training and testing, as well as to protect, restore, and enhance natural resource values while accommodating to the extent possible the production of food, fiber, minerals, and services.

The NTTR RMP consists of a combination of management objectives, management directions, allocations, and guidelines that will direct where actions may occur, the resource conditions to be maintained, and use limitations required to meet the management objectives.

1.6 PLANNING OVERVIEW

Planning on the NTTR has a history closely tied to the public land withdrawal process of recent years. In the mid-1990s, in anticipation of PL 106-65, the Air Force in consultation with other

concerned agencies contracted in 1997 with The Keystone Center of Keystone Colorado to assemble a broad group from the public to address resource planning issues on the NTTR. That effort resulted in publication of a document known as the "Keystone Dialogue on Nellis Air Force Range Stewardship" (Keystone Center, 1998) that has articulated the planning objectives, issues and principles that the public and concerned agencies believe to be appropriate and desirable for the NTTR.

The planning process enables the BLM to address issues and concerns of the public, while complying with the laws and policies established by Congress and the Executive Branch of the Federal Government. The preparation of the NTTR RMP has followed the nine planning steps described below. These steps emphasize public participation at several key stages.

1.6.1 MAJOR PLANNING STEPS

1.6.1.1 **Step 1: Issue Identification**

Issues determine the focus of the NTTR RMP process and indicate specific concerns held by the BLM and the public regarding the planning area. An issue is defined as an opportunity, conflict, or problem pertaining to management of public lands and associated resources. Issue identification is intended to direct an interdisciplinary analysis towards issue resolution. The identification of issues for the NTTR RMP was initiated by BLM managers and resource specialists.

A Notice of Intent (NOI) was published in the *Federal Register,* inviting the public and other federal, state, and county agencies to participate in the planning process. Scoping meetings were held in Beatty, Las Vegas, Alamo, Amargosa Valley, Pahrump, and Tonopah to receive public input.

Issues identified at the public meetings are as follows:

Access

Limited access was an expressed concern. Some commentors want to gain access to maintain water sources, use forage resources, and/or develop and extract other natural resources.

Areas of Critical Environmental Concern

Nye County asked about the possibility of designating ACECs on the NTTR for Amargosa Toads or other species of concern, to reduce the economic impacts on its citizens. There is no known suitable Amargosa Toad habitat on the NTTR, therefore, there is no justification for an ACEC designation for this purpose.

Cultural Resources

Cultural resources need to continue to be identified and protected.

Economic Concerns

There must be recognition of local economic needs. Provide incentives for contracting with local residents. Consider impacts to the local economies of preventing all public access to the range. How to balance the quality of life.

Fire Management

The public expressed an interest in using wild land fire as a management tool. Also, use of prescribed burning was suggested to achieve a vegetative mosaic pattern.

Hazardous Materials

One individual expressed concern about the proper disposal of hazardous waste, and suggested the cleanup of all existing contamination. The individual noted that the BLM 1992 Nellis Air Force Range RMP is silent on management of hazardous materials. All parties must outline a strategy based on current law to define which agencies have management responsibility for cleanup of hazardous material spills or releases.

Lands/Access

A right-of-way application may be submitted to the BLM to haul nuclear waste through the NTTR. Prior to the BLM approving a right-of-way, the military must concur with its issuance. The Air Force has indicated that a right-of-way to haul nuclear waste through the NTTR cannot be supported. The NNSA has no plans that contain a proposal for a right-of-way through the NTTR.

Livestock Grazing

Commentors identified two areas where they believed additional livestock grazing could occur without interfering with the military's mission. The Air Force made a subsequent determination that additional livestock grazing in the areas suggested was not compatible with the military mission. The withdrawn portion of the Bald Mountain allotment is the only area where livestock grazing is allowed.

Noxious Weeds

Several commentors expressed a desire to control noxious weeds, and where possible to restore native vegetation to the site's potential.

Riparian Areas

The public felt that riparian areas are degraded and need protection and felt water should be allocated for riparian areas, with the goal of maintaining Proper Functioning Condition.

Vegetation

The BLM's primary methodology for determining the health of plant communities is by completing an ecological status inventory (ESI). The initial inventory and collection of baseline data are critical to an ongoing monitoring program to ensure vegetation objectives are met. The vegetative survey completed for part of the Nevada Wild Horse Range may provide some ESI data.

Water Resources

Commentors expressed concern about groundwater levels off the NTTR being reduced because of groundwater pumping on the NTTR. They also suggested that additional studies be conducted to assess water quality. Development of new water sources was suggested to ease grazing pressure on existing water sources.

Wilderness

The public suggested the entire planning area should be evaluated for potential designation of wilderness areas. Also, roadless areas greater than 5,000 acres should be identified.

Wild Horses

It is difficult to manage wild horses in the Nevada Wild Horse Range, an administrative unit designated by a 1962 MOU between the BLM and the Air Force.

Other issues identified by the BLM include:

Air Quality

A small part of the planning areas is in hydrographic basin 212, a non-attainment area for the pollutants CO and PM10. A much larger portion of this non-attainment area covers the Desert National Wildlife Range. It is expected that both BLM and USFWS decisions will be consistent with the law as administered by the CCHD.

Timber Mountain Caldera ACEC

The primary issue is whether or not to drop the ACEC designation. The ACEC designation may be redundant because the National Park Service has designated the Timber Mountain Caldera a National Natural Landmark.

1.6.1.2 **Step 2: Development of Planning Criteria**

After issues were identified, planning criteria were formulated to guide development of the NTTR RMP. The criteria are derived from laws, Executive Orders, regulations, planning principles, BLM national and state office guidance, consultation with other agencies, public involvement, and resource data. These criteria collectively set standards for data collection, development of alternative actions, and selection of the preferred alternative and preparation of the final plan. Planning criteria ensure that the plan addresses identified issues and avoids unnecessary data collection and analysis.

Proposed planning criteria are as follows:

A. The primary use of the withdrawn area is military training and testing. The management of specified natural resources is subserviant to the military mission.
B. Actions implemented by the BLM, Air Force, and/or other organizations must comply with applicable laws, executive orders, and regulations including Public Law 106-65.
C. The planning area is defined as lands within the boundary of the NTTR that were withdrawn from the BLM. The planning area does not include any portion of the DNWR.
D. The NTTR RMP will not make decisions about specific developments to enhance rangeland, wildlife, and/or watershed quality. Activity level planning decisions (i.e., habitat management plans, allotment management plans, fire management plan) will occur in subsequent activity-level plans.
E. The management and/or protection of water, water resources, riparian zones, and other related values will have a high priority.
F. The BLM will use a Geographic Information System (GIS) to analyze decisions about resource use, when appropriate spatial data are available.
G. Watershed determinations will be based on hydrographic basins. (www.state.nv.us/cnr/ndwp/basins/hy_basin.htm)
H. The NTTR plan will incorporate methods for appropriate amendment of the plan on a regularly scheduled basis, and for monitoring progress on management decisions.
I. The NTTR plan will be consistent to the maximum extent possible with the plans and management programs of local governments. Also, it will be consistent with federal laws and guiding regulations and will be coordinated with other federal agencies where appropriate.
J. Public participation will be a factor in the decision-making process. The Keystone Dialogue helped guide preparation of the NTTR plan based on previous coordination with the public.
K. Valid existing management decisions from the *1992 Nellis Air Force Range Resource Plan* will be brought forward into the Draft NTTR RMP, with relevant objectives and management directions carried forward into the NTTR plan.
L. The NTTR planning effort will rely largely on existing available resource inventories and assessments. Limited data (largely for hydrologic resources) will be gathered during the planning process. Any management decisions requiring additional inventories will be deferred until such time as the inventories are available.
M. Resource use and/or extraction will continue, but within the context of maintaining desired vegetative communities, stabilized soils, and visual quality.
N. Within the air quality non-attainment area, the BLM will follow CCHD regulations.

1.6.1.3 **Step 3: Inventory and Data Collection**

This step involves collection and compilation of biological, physical, social and economic data in various forms from available sources to help resolve the planning issues. These data provide essential facts for conducting analysis and evaluations, and making decisions.

1.6.1.4 **Step 4: Analysis of the Management Situation**

An *Analysis of the Management Situation* (AMS) is a concise assessment of the current situation. An AMS describes current BLM guidance, identifies existing problems and opportunities for their resolution, and consolidates existing data needed to analyze and resolve the identified issues. If sufficiently developed, the portion of the AMS that describes present management (no action alternative) and affected environment may be used directly in the plan and environmental impact statement (EIS).

The intent for the NTTR RMP is to completely incorporate the AMS into the body of the plan. A separate document is not needed based on many recent documents that provide information including the Renewal of the Nellis Air Force Range Land Withdrawal Legislative EIS, the Integrated Natural Resource Management Plan for the NTTR prepared by Nellis Air Force Base, and the Keystone Dialogue. These documents extensively describe potential management, current conditions and management recommendations for the NTTR. BLM will incorporate by reference where appropriate to reduce this planning document's size. There are five main resource issues that will be the focus of the NTTR plan: 1) wild horse management, 2) livestock grazing, 3) fire management, 4) noxious or invasive weed management and 5) wildlife habitat. Questions the BLM needs to resolve in the NTTR plan are: a) On what portion of the NTTR will BLM manage for wild horses? b) Where will the BLM focus fire management activities to enhance wildlife and wild horse habitat or reduce hazardous fuels? c) How will the BLM remove noxious and invasive weeds throughout the NTTR? d) How will the BLM provide quality habitat for wildlife and wild horses in areas where wildlife and wild horses potentially compete for water and/or forage? and e) How will the BLM manage livestock grazing on the withdrawn portion of the Bald Mountain allotment?

Ongoing and/or new efforts will continue to fill in all data gaps and to project needed management directions to ensure rangeland health standards are met. The BLM Manual H-4180-1 - Rangeland Health Standards will provide guidance for assessing the health of the land and to identify appropriate actions to achieve, or make progress toward achieving, specified rangeland health standards.

1.6.1.5 **Step 5: Formulation of Alternatives**

This step involves developing alternatives that consider the issues, planning criteria, and concerns raised during the scoping period. All alternatives will be presented for management consideration. The No-Action alternative (i.e., continuation of present activities) is required. The purpose of the other alternatives is to resolve issues while emphasizing different levels of management intensity.

1.6.1.6 **Step 6: Estimation of Effects of Alternatives**

In accordance with the National Environmental Policy Act (NEPA), the physical, biological, social, and economic effects of implementing each alternative are analyzed to compare and evaluate impacts. This step involves completing a general analysis of the issues and concerns for the planning area. (*Note*: Site-specific NEPA documents will be prepared for specific projects and proposals on an activity plan or project-specific basis.)

1.6.1.7 **Step 7: Selection of Preferred Alternative**

A Preferred Alternative will be selected after completing the analysis and resolution of the issues, resources affected, and management guidance in the existing land-use plan. The Preferred Alternative may combine elements from the other alternatives to achieve maximum management

flexibility in lands-related actions while continuing to meet the goals and objectives of BLM's multiple-use mandate.

The Preferred Alternative, which will be recommended to the BLM Nevada State Director, will be determined based on the issues and concerns identified through the planning process; information obtained from public meetings and written comments; formal coordination and consultation with other agencies; decision criteria developed and considered by management; and impact analyses of the alternatives. The BLM Nevada State Director will review the selected alternative for approval. After the BLM Nevada State Director approves the Preferred Alternative, the Draft NTTR plan will be distributed to the public, including other government agencies and interest groups, for a 90-day review and comment period.

1.6.1.8 **Step 8: Selection of the Proposed Plan**

The Las Vegas Field Office Manager, in cooperation with the Air Force will develop a proposed plan considering public comments and other data, including an estimate of potential effects. Following the public review and comment period, the BLM's Las Vegas Field Office Manager will recommend a proposed plan to the BLM Nevada State Director for approval. After evaluating public comments, the BLM may retain the preferred alternative as the proposed plan, reassess and modify the preferred alternative to meet management needs, utilize portions of each alternative, or modify a previously analyzed alternative.

The proposed plan should be within the range of alternatives selected for detailed study and analysis. After reviewing the recommended proposed plan, the Nevada State Director will issue a Notice of Availability through the *Federal Register*, file the NTTR plan with the EPA, and distribute the document to the public.

The Governor of the State of Nevada will be given a 60-day consistency review period to determine the consistency of the NTTR RMP with plans and policies developed by state and local government. This review period will begin with the Governor's receipt of the document.

A 30-day protest period will begin when the NTTR RMP is filed with the EPA. If no protests are received during this time, the BLM Nevada State Director will approve the plan and publish an Approved NTTR Resource Management Plan/Record of Decision. Any protests that are received will be resolved by the BLM Director before the NTTR plan is approved and the NTTR Resource Management Plan/Record of Decision is published.

Within 90 days after NTTR Resource Management Plan approval, a specific Implementation Plan will be developed to identify program priorities for the Plan's decisions and to determine the sequence and costs associated with their implementation. Site-specific NEPA documents will be prepared prior to initiating resource projects and proposals to analyze potential environmental impacts. Mitigation measures will be developed and incorporated as special stipulations into authorization permits.

1.6.1.9 **Step 9: Monitoring and Evaluation**

Monitoring and evaluation will be conducted at intervals not to exceed five years, for the following purposes:

- Determine effectiveness of the resource management plan in resolving issues.
- Ensure effectiveness of mitigation measures. Verify assumptions used in assessing impacts.
- Review whether changes have occurred in related plans of other federal agencies, and state or local governments.
- Determine whether implementation of the NTTR RMP is achieving desired results.

Information gained through monitoring and evaluation will be incorporated into future planning, including any amendments or revisions to the NTTR RMP.

Land-use actions would be implemented after the BLM Nevada State Director approves the NTTR plan's Record of Decision. The NTTR plan's decisions become final with issuance of the Record of Decision. Specific management prescriptions for ACEC would be implemented when activity-level management plans are developed and appropriate clearances are completed.

1.6.2 CONSISTENCY WITH OTHER PLANS

There are no known inconsistencies between any of the proposed alternatives and the officially approved and adopted resource-related policies and programs of other Federal agencies, state, and local governments. Existing land-use plans that cover the planning area, and lands contiguous to the planning area are the: *Tonopah Resource Management Plan, Nellis Cultural Resource Management Plan, Integrated Natural Resource Management Plan for the Nellis Range, Nevada Test Site Resource Management Plan, December 1998,* and *Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada, August 1996.*

Continuing coordination and consultation will take place during the public comment period on the Draft RMP/EIS, the Preliminary RMP/Final EIS (PRMP/FEIS), and the Approved RMP/Record of Decision (ARMP/ROD). As previously noted, the Governor of Nevada will have 60 days to review the PRMP/FEIS to determine consistency with state plans before issuance of the ARMP/ROD.

THIS PAGE DELIBERATELY LEFT BLANK

CHAPTER 2
ALTERNATIVES

2.1 INTRODUCTION

This chapter describes the management objectives and directions contained in four alternatives (A, B, C, and D), including "No Action" (Alternative A). Each alternative description begins with an overall "goal" statement, followed by a description of the objectives and management direction for each BLM-managed resource and program. The objectives and management directions for Alternatives A and B are presented in the same sequence that the relevant resources and programs are addressed in the discussion of the affected environment (Chapter 3). All objectives in Alternative B, other than those related to wild horses, apply to Alternatives C and D. Objectives and management direction for Alternatives C and D are presented only for wild horses which would be managed differently from Alterative B.

Since the NTTR is not open to public access and is, in essence, a protected area, the planning team did not see a need to prescribe different management under each alternative for each resource, other than wild horses.

The fact that the alternatives are essentially the same for all resources and programs other than wild horses is a function of the purposes of the withdrawal. The BLM has little leeway on how different resources are to be managed within the withdrawn lands. Air Force requirements include operational areas, target arrays, plus critical safety and security provisions. Maintaining the wild horse herds must be compatible and supportive of the mission operations, the safety of the range staff, and allowing the Air Force to provide necessary security.

The NTTR military mission responds to real world threats and, thus, security can be elevated during sensitive times. These heightened security requirements can preclude BLM resource managers from executing their mission. Because of the changing nature of the Air Force requirements, only the military can determine the impact of wild horses and wild horse management on the military mission. Both the BLM and the Air Force want to reduce the possibility of horses being on active bombing ranges where live targets are maintained for aircrew testing and training. Operational impacts to the Air Force include inadvertently injuring horses during mission operations, and taking employee work hours from mission work to haul water to horses when natural resources are exhausted.

Objectives and management direction for the air, soil, water, and riparian resources that are impacted by other resource programs are included in those program sections. To avoid redundancy, these objectives and management direction are not repeated within the air, soil, water, and riparian sections.

2.2 ALTERNATIVE A: NO ACTION

The No-Action alternative (see Figure 2-1) represents the management objectives and directions contained in the approved BLM 1992 Nellis Air Force Range Resource Management Plan. Those changes that have occurred since 1992 are outlined at the end of the section (in Section 2.2.8). This alternative is the basis for comparison between the other alternatives.

The objectives, management directions and management actions of the existing RMP which have been, or have not been, implemented are presented. No new management is proposed in this alternative.

2.2.1 PHYSIOGRAPHY, CLIMATE AND VISUAL RESOURCES

2.2.1.1 **Visual Resources**

Objectives

1. To maintain the integrity of visual resources in the natural areas.
2. To protect visual resources in the planning area while allowing for development.

Management Directions

1. Assign visual resource management (VRM) classes in accordance with BLM guidance and policy.
2. Ensure all actions initiated or authorized by BLM are in compliance with VRM guidelines.

Management Actions

1. Manage the Groom Mountain Range addition for VRM Class III and IV values (see Figure 2-2).
2. Manage the Timber Mountain Caldera National Natural Landmark as VRM Interim Class II.
3. Manage the remainder of the planning area as VRM Interim Class IV (see Figure 2-2).

2.2.2 AIR RESOURCES

All BLM activities, and BLM-authorized activities, will be managed to prevent air quality deterioration beyond the thresholds established by the Nevada Ambient Air Quality Standards.

2.2.3 GEOLOGY, MINERAL RESOURCES AND SOILS

2.2.3.1 **Mineral Resources**

1. Pursuant to PL 99-606, the Nellis Air Force Range (now NTTR) is withdrawn from all forms of appropriation under the mining laws and the mineral leasing and the geothermal leasing laws.
2. PL 100-338 amended PL 99-606 to include the Groom Lake Addition. This addition contains valid existing mineral rights. Twenty-five unpatented mining claims will continue to be recognized. If any of the valid existing rights are eliminated by relinquishment or purchase by the Air Force, the mineral rights will revert to the United States.
3. At the beginning of the planning effort, the BLM, after conferring with the Nellis Air Force Base, determined that no lands within the NTTR were suitable for opening to mineral exploration and development. To comply with Section 12 of the Act, in November 1991, and every five years thereafter, the BLM will, with the Air Force concurrence, determine which, if any, of the withdrawn public lands will be opened for operation under the Mining Law of 1872, the Mineral Lands Leasing Act of 1920, as amended, the Mineral Leasing Act for Acquired Lands of 1947, the Geothermal Steam Act of 1970, or any one or more of such Acts. If any lands are opened following these reviews, the management of mineral resources will be addressed in an amendment to this RMP.

(Note: Oil and gas leases N-26566 and N-26577, which were all or partially included in the Groom Mountain Adition, expired on March 31, 1991. All of lease N-26566 and a portion of lease N-26577 are located within the military withdrawal area and will not be available for re-leasing unless otherwise determined to be open during any of the evaluations to be conducted every five years.)

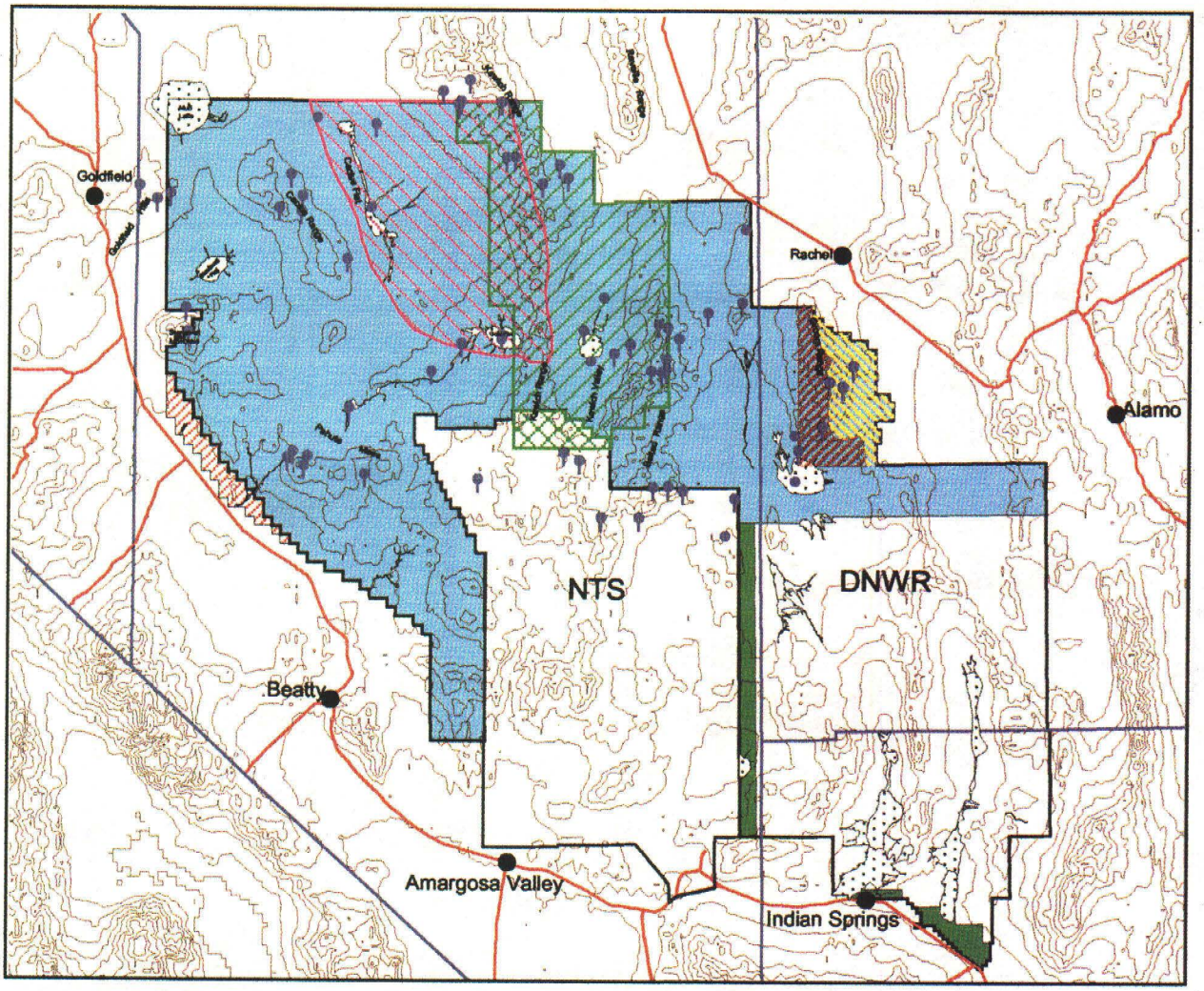


Figure 2-1. Alternative A, the No-Action Alternative. This alternative is from the 1992 NRRMP/ROD (BLM, 1992).

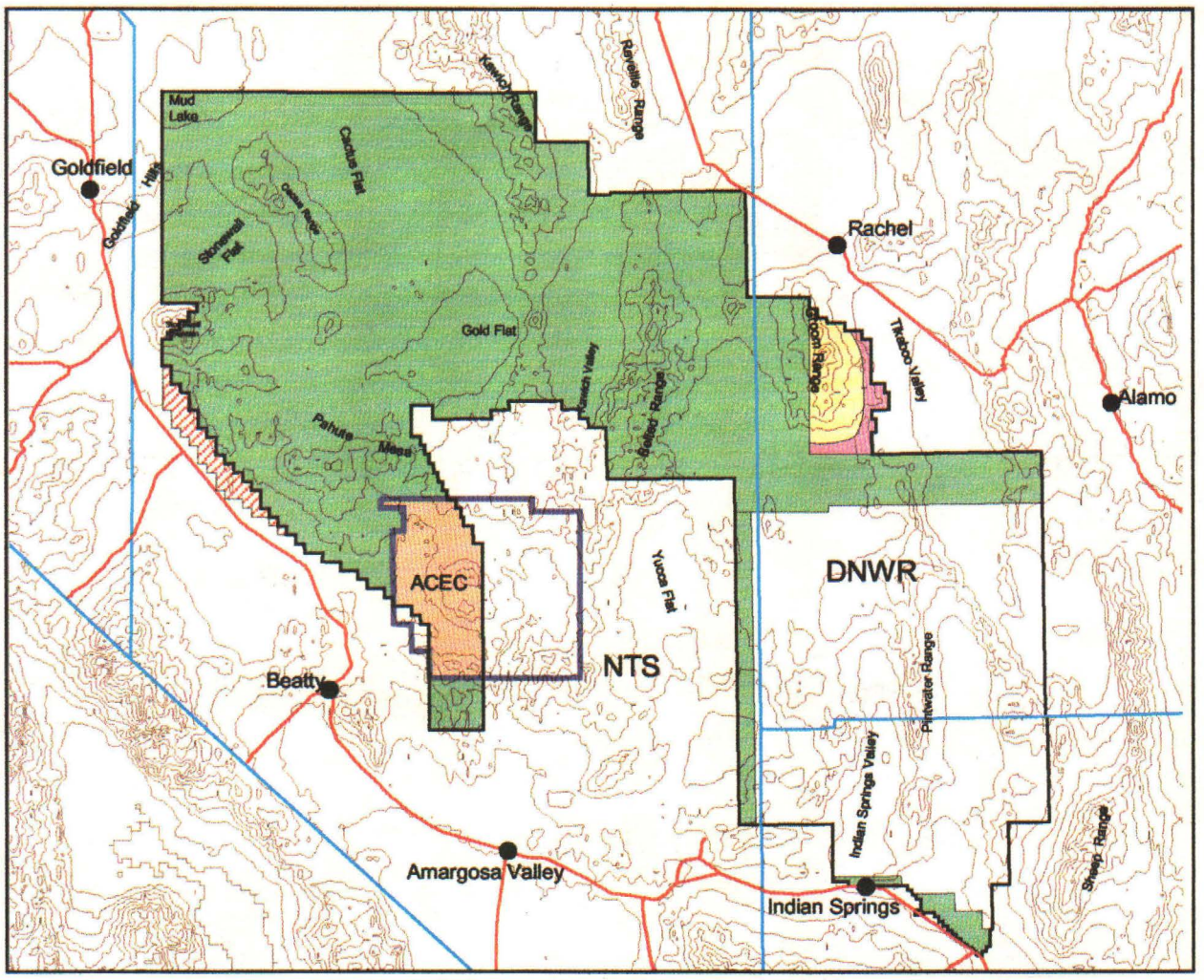


Figure 2-2. Visual Resource Management and Area of Critical Environmental Concern.

2.2.3.2 **Soils**

Soils will be managed to maintain or improve rangeland productivity and to minimize present and potential wind and water erosion.

2.2.4 HYDROLOGY AND WATER RESOURCES

2.2.4.1 **Water Resources**

Water quality will be maintained or improved in accordance with federal and state standards. Consultations will be undertaken with the state agencies for proposed projects that may significantly affect water quality. BLM, in consultation with the Air Force, will apply for water rights with the State of Nevada for use by wild horses, wildlife, and livestock.

2.2.5 BIOLOGICAL RESOURCES

2.2.5.1 **Vegetation**

Objectives

1. To maintain existing species diversity and composition at existing ecological stages, except in disturbed and riparian areas.
2. To maintain a static-to-upward trend in vegetation characteristics through control of grazing levels.

Management Directions

1. Use species native to the area for any re-vegetation efforts.
2. Restrict surface-disturbing activities in special status plant species habitat or riparian areas.
3. Continue to develop and maintain permanent water sources on the NWHR to achieve proper distribution of horses and utilization of forage.
4. Develop and maintain water sources on the Bald Mountain grazing allotment to achieve proper distribution of livestock and utilization of forage.
5. Use fencing only when monitoring demonstrates that other management practices are not successful in achieving the identified objectives.
6. Monitor vegetation resources in the planning area to determine the effectiveness of management actions.

Management Actions

1. Develop activity plans for riparian areas throughout the planning area.
2. If monitoring demonstrates that the above-listed management practices are not successful in protecting and/or restoring the productivity of riparian areas, construct and maintain up to 50 miles of fence to exclude wild horse and livestock from riparian areas.

2.2.5.2 **Riparian Resources**

Objective

To protect and, if necessary, to improve and restore the condition of riparian areas.

Management Direction

Protect and enhance riparian habitat areas on the Nevada Wild Horse Range and on the Bald Mountain grazing allotment.

2.2.5.3 **Sensitive Species**

Objective

To protect threatened and endangered wildlife and their habitat.

2.2.5.4 **Wildlife Habitat**

Objectives

1. To manage wildlife habitat (exclusive of the NWHR and Bald Mountain grazing allotment) for maximum wildlife value.

2. To mange wildlife habitat within the NWHR and the Bald Mountain allotment to sustain viable wildlife populations.

Management Directions

1. Forage outside the boundaries of the NWHR and the Bald Mountain grazing allotment will be managed for wildlife.
2. Continue to reserve forage for the wildlife in the Bald Mountain grazing allotment at current levels (370AUMs for deer).
3. Manage the forage on the NWHR to achieve and maintain a thriving ecological balance.
4. Provide permanent water sources for wildlife on the NWHR and the Bald Mountain grazing allotment. NOT FOR HIS but what
5. Conduct monitoring as a joint effort, in conjunction with Air Force and the NDOW.

Management Actions

1. Develop and maintain up to 20 NOT FOR HIS water sources for wildlife within the Nevada Wild Horse Range and the Bald Mountain grazing allotment.
2. If monitoring indicates the need, build and maintain up to 30 miles of boundary fence on the Bald Mountain grazing allotment to prevent livestock from drifting off the allotment.
3. Authorize predator control, as required through the District Animal Damage Control Plan (ADC), in coordination with the BLM, Air Force, the NDOW and the Animal and Plant Health Inspection Service of the U.S. Department of Agriculture.

2.2.5.5 **Forestry/Woodlands**

Forestry Products

The sale of forest products are not authorized in the planning area.

Fire Management

The BLM will conduct fire management activities on the NTTR in accordance with the Fire Management Reciprocal Agreement between the Air Force and BLM.

2.2.5.6 **Livestock Grazing**

Objectives

1. The NTTR will continue to be closed to livestock grazing except for that portion of the Bald Mountain grazing allotment in the Groom Mountain Range Addition (see Figure 2-1).
2. The Naquinta Springs Allotment is closed to all livestock grazing.

Management Direction

1. The Bald Mountain allotment is categorized as a maintenance "M" category allotment. If monitoring determines a need, an allotment management plan will be developed to systematically control livestock grazing use levels and use patterns.
2. A total of 800 animal unit months of forage for cattle will be authorized from June 1 to March 31.
3. The following range improvements will be constructed, if needed, to achieve proper management (this includes the entire allotment and was analyzed in the Caliente Grazing EIS): 1 well, 8 miles of pipeline, 2 spring developments, 4 corrals, and 800 acres of vegetation manipulation by controlled burning.

2.2.5.7 **Wild Horses**

The 1992 NRRMP/ROD mapped the NWHR as covering approximately 390,730 acres, of which 23,280 acres now are within the NNSA (DOE) land withdrawal (PL 106-65). It also mapped an area referred to as the "1971 Wild Horse Use Area" that encompasses approximately 356,770 acres. These two mapped areas are not coincident; they overlap for

only approximately 99,630 acres. The combined mapped area is approximately 647,870 acres.

Objectives

1. To maintain and manage populations of wild, free-roaming horses only on the NWHR.
2. To maintain the Nevada Test and Training Range as a burro-free area.
3. To achieve a thriving ecological balance consistent with other resource values.

Management Directions

1. The BLM will manage wild horses on the Nevada Test and Training Range as authorized through the Cooperative Agreement of February 8, 1974, with the Nellis Air Force Base. This cooperative agreement identifies the area for management of the wild horses as the NWHR and describes its location by legal description (see Figure 2-1).
2. Adjust wild horse numbers to achieve a thriving ecological balance using data obtained from monitoring and if available, other sources.
3. Develop and implement a gathering plan for the removal of all wild horses outside the NWHR Herd Management Area.
4. Continue to conduct annual censuses to determine wild horse populations on the NWHR and the remainder of the planning area.
5. Continue to conduct gatherings, relocations and removals to enhance color markings in specified areas.
6. Continue to monitor the physical condition of the animals.
7. Continue to conduct studies to determine productivity, survival, sex ratio, age structure, seasonal movement and home ranges.
8. Continue to develop and maintain permanent water sources on the NWHR.
9. Continue to conduct vegetation trend and utilization studies.
10. Use fencing only when monitoring demonstrates that other management practices are not successful in achieving the identified objectives.
11. Delineate 1971 wild horse use areas (see Figure 2-1).

Management Actions

1. Conduct gatherings to achieve a thriving ecological balance on the NWHR.
2. Conduct gatherings to remove wild horses outside the boundaries of the NWHR.
3. Develop or improve water sources on the NWHR, including, but not limited to, the following springs: Cedar Wells, Upper and Lower Corral, Silverbow, Rose, Tunnel and Cedar.
4. Remove all burros from the planning area.
5. Amend, if necessary, the NWHR Herd Management Area Plan (HMAP) to conform with this resource plan.
6. If monitoring demonstrates that the above management practices are not successful in preventing wild horse use outside of the NWHR, build and maintain up to 125 miles of boundary fence on the NWHR.
7. If monitoring demonstrates that the above management practices are not preventing wild horses and burros from moving onto the planning area from adjacent lands, build and maintain up to 75 miles of fence to selectively fence the boundary of the planning area.

2.2.6 CULTURAL AND HISTORICAL RESOURCES

2.2.6.1 **Objective**

Cultural resources will be managed to conserve and protect the full array of archaeological, historical, paleontological, natural history, and socio-cultural resources present in the planning area.

2.2.6.2 **Management Directions**

1. Prior to authorizing any surface disturbing activities, or initiating any surface disturbing activities, the activity will be evaluated in compliance with the Statewide Protocol Agreement, dated August 8, 1990, and all subsequent amendments to it.
2. Paleontological resources will be managed through the issuance of research and scientific use permits and by consideration in all environmental documentation for surface disturbing activities.

2.2.7 LAND STATUS, DESIGNATIONS AND USES

2.2.7.1 **Access**

The NTTR will remain closed to the general public. Permits for access to the planning area are provided by the Air Force for specific purposes and will be subject to security clearances, scheduling and safety constraints.

2.2.7.2 **Lands Program**

Rights-of-Way

1. Lands within the planning area will continue to be available for rights-of-way (ROW). The BLM will issue ROWs for nonmilitary uses only with the concurrence of the Secretary of the Air Force.
2. Utility corridors will not be designated in the planning area.

Disposals

Lands in the planning area are not available for disposal.

Land-Use Authorizations

Lands within the planning area will be available, on a limited basis, for some land use authorizations. Nonmilitary land use authorizations, such as leases and permits, will be issued only with the concurrence of the Air Force.

2.2.7.3 **Natural Areas and Areas of Critical Environmental Concern**

Natural Areas

The Timber Mountain Caldera National Natural Landmark will continue as designated. No new areas will be designated as Research Natural Areas, Outstanding Natural Areas or Natural Hazard Areas within the planning area.

Areas of Critical Environmental Concern

Objective

To protect officially recognized natural areas.

Management Direction:

1. All officially recognized natural areas will be designated as areas of critical environmental concern (ACEC).
2. All ACECs will be managed primarily for their natural values.

Management Action:

Designate that portion of the Timber Mountain Caldera National Natural Landmark located within the planning area as an ACEC (see Figure 2-2).

2.2.7.4 **Recreation**

Access restrictions on the NTTR preclude all unrestricted recreational opportunities in the planning area. Should negotiations currently underway between the Air Force and the NDOW conclude in the opening of a 26-square-mile area on Stonewall Mountain for limited access bighorn sheep hunting, this area will be managed for its recreational hunting potential. (Note: negotiations to this effect were concluded in 1986.)

2.2.7.5 **Wilderness Designations**

The NTTR planning area does not contain any land that meets the minimum criteria for consideration as a wilderness study area. No areas will be recommended for management as wilderness.

2.2.8 RMP INITIATIVES AND CHANGES SINCE 1992

2.2.8.1 **Physiography, Climate and Visual Resources**

Visual Resources

The management classes were assigned through the planning process. There will be no change from the existing resource plan.

2.2.8.2 **Air Resources**

The existing Resource Plan is silent on the Las Vegas non-attainment area for CO and PM10.

2.2.8.3 **Biological Resources**

Vegetation

Vegetation has noticeably recovered since 6,481 animals were removed in the mid to late 1990s. Some springs are now fenced and the riparian areas are also recovering. Additional vegetation data are needed to accurately assess current conditions.

Fire Management

The National Fire Plan is policy and will be the basis for management under all alternatives.

Livestock Grazing

The season of use presented in the existing resource plan does not allow livestock use during the months of April and May. Historically this was a year-round grazing allotment, and no decision was ever issued to officially change the season of use. There is no documentation as to why the season of use was changed.

Wildlife Habitat

Wildlife habitat was adversely impacted when the horse numbers were too high. Since the horse population has been reduced, wildlife habitat has improved. Baseline habitat data are needed to assess existing and future habitat conditions. Ecological balance should be met with lower horse numbers.

Wild Horses

Management objectives in the existing plan are difficult to meet based on a Herd Management Area confined to the NWHR. Furthermore, PL 106-65 changed management authority for a portion of the NWHR that was on Pahute Mesa and is now part of the area administered by the NNSA.

2.2.8.4 **Land Status, Designations and Uses**

Area of Critical Environmental Concern

That portion of the Timber Mountain Caldera National Natural Landmark located within the planning area was officially designated as an Area of Critical Environmental Concern (ACEC) upon approval by the BLM Nevada State Director on February 21, 1992. The new withdrawal legislation, PL 106-65, transferred a small portion of the BLM-designated ACEC to the DOE NTS. The area is no longer under the jurisdiction of the Secretary of the Interior. The area is now administered by the Secretary of Energy, specifically the NNSA. The change to the ACEC boundary within the NTTR is reflected on Figure 2-2 and is included, as well, in each alternative.

Recreation

The Air Force and the NDOW did in fact negotiate an agreement to allow bighorn sheep hunting in the Stonewall Mountain area. The BLM anticipates that this agreement will continue in affect.

2.2.8.5 **Cultural Resources**

Management will be consistent with the cultural resources plan written by Nellis AFB and additional guidance from the recently developed Statewide Protocol for Cultural Resource Management.

2.3 ALTERNATIVE B

Alternative B addresses the full spectrum of resources to be managed in the planning area. It provides for habitat improvements, control/eradication of weeds and noxious plant species, protection of sensitive plant and animal species, protection and enhancement of riparian zones, management of vegetation resources through prescribed burns, livestock grazing management, and cultural resources management. Importantly, it also represents an interpretation of available data to identify the area for management of the wild horses on the NTTR (Figure 2-3). Wild horse management on NTTR is one of the most important resource management issues.

This alternative identifies a herd area (HA) consistent with data that suggest wild horses used much of the North Range in 1971. This entire 1971 herd area is identified as the herd management area (HMA). A smaller portion of this HMA is identified within which the appropriate management level (AML) of horses would be calculated. This alternative allows for drift of horses seasonally from the AML core (see Figure 2-3), and focuses on the removal of any wild horses that establish a permanent home range outside the core area used to determine AML. With built-in safeguards for habitat improvement, the impacts of horse grazing would be monitored closely with adjustments made in the number of horses based on habitat conditions.

2.3.1 PHYSIOGRAPHY, CLIMATE AND VISUAL RESOURCES

2.3.1.1 **Visual Resources**

Objectives

1. Maintain the integrity of visual resources in the natural areas.
2. Protect visual resources in the planning area while allowing for development.

Management Direction

1. Ensure all actions initiated or authorized by BLM are in compliance with visual resource management (VRM) guidelines.
2. Manage the Groom Mountain Range addition for VRM Class III and IV values, and the Timber Mountain Caldera National Natural Landmark as VRM Interim Class II, with the remainder of the planning area as VRM Interim Class IV (see Figure 2-2).

2.3.2 AIR RESOURCES

2.3.2.1 **Objective**

Ensure that actions in the planning area do not violate local, state, tribal and Federal air quality laws, regulations, and standards.

2.3.2.2 **Management Direction**

1. Ensure that the planning process addresses air quality considerations by incorporating objectives and actions into resource activity plans, such as Allotment Management Plans, Habitat Management Plans, and Watershed Management Plans. Where applicable, include "conformity" demonstration in site-specific activity plans and/or National Environmental Policy Act documentation.

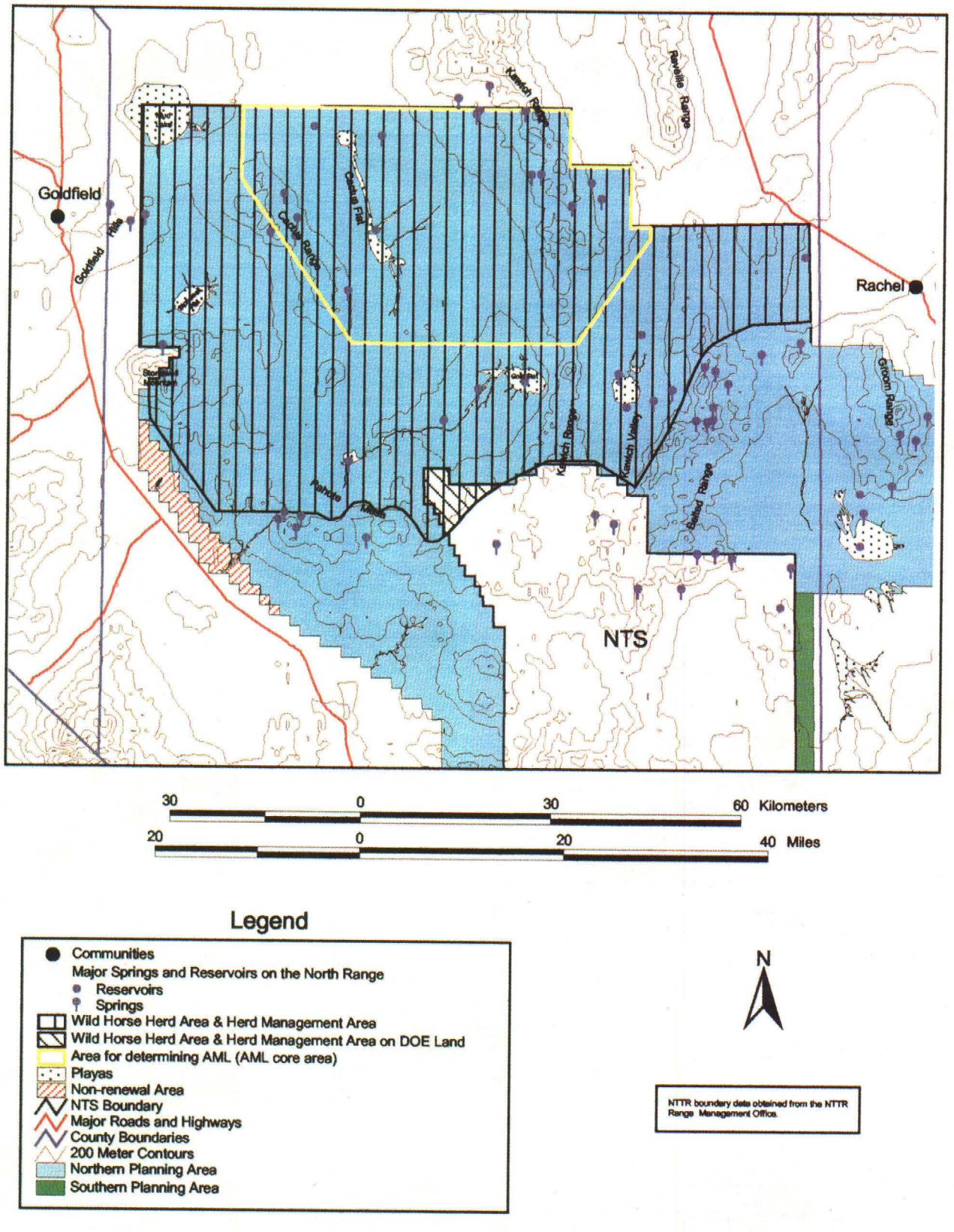


Figure 2-3. Alternative B. Delineation of the agency preferred proposed herd area, herd management area, and the area used to determine Appropriate Management Levels (AMLs).

2. Permit only those activities on the withdrawn lands that are consistent with Federal, State, and local air quality standards and regulations. Require that all appropriate air quality permits for land use actions are obtained before BLM and/or Air Force approval the action. Where applicable, demonstrate how proposed management actions comply with local, state, tribal and Federal air quality laws, regulations, and standards (Conformity; per 40 CFR 93.100 et seq).

2.3.3 GEOLOGY, MINERAL RESOURCES AND SOILS

2.3.3.1 **Mineral Resources**

Objectives

1. Provide for the orderly extraction of sand and gravel by the Air Force for use within the NTTR.
2. Provide the BLM with an annual production report of the amount of free use material removed from each borrow pit on the NTTR.
3. Use appropriate environmental standards to allow for the preservation and enhancement of fragile and unique resources.

2.3.3.2 **Soils**

Objective

Assess erosion conditions and reduce erosion and sedimentation while maintaining or where possible enhancing soil productivity through the maintenance and improvement of watershed conditions.

Management Direction

On watersheds that exhibit good potential for recovery, implement protective and or restoration measures.

2.3.4 HYDROLOGY AND WATER RESOURCES

2.3.4.1 **Water Resources**

Objective - A

Maintain the quality of waters presently in compliance with state and/or federal water quality standards.

Management Direction - A

Use Best Management Practices, as identified by the State of Nevada, to minimize contributions from both point and non-point source pollution.

Objective - B

Ensure availability of adequate water to meet management objectives including the recovery and/or re-establishment of Special Status Species.

Management Direction - B

Determine water needs to meet management objectives. File for appropriative water rights on public lands in accordance with the State of Nevada water laws. By terms of the land withdrawal (PL 106-65) there are no federally reserved water rights on the NTTR.

2.3.5 BIOLOGICAL RESOURCES

2.3.5.1 **Wildlife**

Objective - A

Support viable and diverse wildlife populations by providing and maintaining sufficient quality and quantity of food, water, cover, and space to satisfy needs of wildlife species using habitats on withdrawn public land.

Management Direction - A

1. Maintain and improve bighorn sheep habitat by maintaining existing water developments, judicious use of prescribed fire, constructing additional water developments, and protecting/improving springs, seeps and riparian habitat, consistent with BLM policy.
2. Evaluate discretionary activities proposed in bighorn sheep habitat on a case-by-case basis. Grant authorization if the proposed actions are consistent with goals and objectives of the *Rangewide Plan for Managing Desert Bighorn Sheep Habitat on Public Lands* (U.S. Dept. of Interior, BLM 1988) and other applicable policies.
3. Maintain and improve mule deer and antelope habitat based on the forage and water needs of each species.
4. Protect sage grouse habitat from ground disturbing activities when and where possible. Coordinate with appropriate state and federal agencies prior to habitat disturbance.
5. Protect water sources that may benefit or harm wildlife by providing a minimum buffer for permitted activities, consistent with the military mission of the withdrawal.
6. Protect and improve key nesting areas, migration routes, important prey base areas, and concentration areas for birds of prey.
7. Protect and improve important non-game resting/nesting habitat in riparian areas and other important habitat types. Discourage projects that may adversely impact the water table supporting these plant communities.

Objective - B

Evaluate wildlife habitat quality and quantity on the NTTR and where appropriate re-establish appropriate native fauna (including naturalized species) to historic use areas, and/or increase population numbers in current use areas.

Management Direction - B

1. Cooperate with state and federal wildlife agencies in implementing introductions, re-introductions, and augmentation releases of native and/or naturalized species (such as desert bighorn sheep, and chukar), and as appropriate, capture of these species for relocation and stocking purposes.
2. Design water developments for wild horses and livestock to reduce potential conflicts with bighorn sheep and/or other wildlife.
3. Animal damage control activities may be allowed to meet management directives for wildlife species.

2.3.5.2 **Vegetation**

Objective - A

Maintain or improve the condition of vegetation on withdrawn public lands to a Desired Plant Community or to a Potential Natural Community.

Management Direction - A

Manage to achieve a Desired Plant Community or a Potential Natural Community.

Objective - B

Restore plant productivity for desired species on disturbed areas.

Management Directions - B

1. Rehabilitate, reclaim, or revegetate areas subjected to surface-disturbing activities, where feasible. When rehabilitating disturbed areas, manage for a desired plant community by seeding native species, except where non-native species are more appropriate.
2. Remove noxious and invasive weeds from public lands consistent with the integrated weed management techniques for removal. Ensure close coordination with state, county,

tribal and other federal agencies, including but not limited to the USFWS, and the Air Force, on control efforts.

2.3.5.3 **Riparian Resources**

Objective

Maintain a desired plant community that provides vegetation and habitat for wildlife, fish, and watershed protection; ensure that all riparian areas are in proper functioning condition by achieving an advanced ecological status, except where resource management objectives require an earlier successional stage. Manage vegetation consistent with vegetation management objectives (Section 2.3.5.2).

Management Directions

1. Complete a Proper Functioning Condition assessment on all riparian areas, and include a description of actions necessary to achieve Proper Functioning Condition on all areas identified as functioning at risk or non functioning.
2. Improve riparian areas, giving priority to areas "Functioning at Risk" with a downward trend. Implement measures to protect riparian areas, such as fencing and/or alternate water sources away from the riparian area.
3. Use integrated weed management techniques, such as burning, chemical, biological or mechanical treatments, to control and eradicate tamarisk and other noxious weeds in areas where potential for treatment is good. Rehabilitate the area with native species to help reduce the potential for re-establishment, and to improve ecosystem health.

2.3.5.4 **Sensitive Species**

Special Status Species are all plant and animal species listed as "threatened or endangered" under the Endangered Species Act of 1973, as amended, candidate species under the Endangered Species Act, state-listed species, or species otherwise identified by the BLM Nevada State Director.

Objectives -A

1. Manage habitat for special status species at the potential natural community or the desired plant community, according to the need of the species.
2. Manage habitat to maintain and/or increase the total number of populations of federally listed species and/or the number of individuals in existing populations, so the requirements for de-listing or down-listing species under the Endangered Species Act will be achieved. Manage habitats for non-listed special status species to support viable populations so that future listing would not be necessary.

Management Direction - A

1. Enter into conservation agreements with the USFWS and the State of Nevada to reduce the necessity of future listings of the species of concern. Conservation agreements may include, but not be limited to, the following: Merriam bearpoppy, and white-margined penstemon.

Objective -B

Manage desert tortoise habitat to achieve the recovery criteria defined in the *Tortoise Recovery Plan* (USFWS, 1994) and ultimately to achieve delisting of the desert tortoise. When the population in a recovery unit meets the criterion as outlined in the *Tortoise Recovery Plan*, it may be considered recovered and eligible for delisting. (For a complete criteria listing see the *Tortoise Recovery Plan,* USFWS, 1994.)

Management Direction - B

Ensure desert tortoise habitat conditions are consistent with the direction identified in the vegetation Objective A and Management Direction A (see Sec. 2.3.5.2).

2.3.5.5 **Forestry/Woodlands**

Forestry Products

The sale of forest products are not authorized in the planning area.

Fire Management

Objective

Provide for fire management as well as prescribed fire for fuel reduction and resource enhancement purposes, following guidelines in the National Fire Plan.

Management Directions

1. Provide fire suppression efforts commensurate with resource and adjacent property values at risk.
2. Prevent human-caused fires through an aggressive education, investigation, and public outreach effort.
3. Provide for maximum fire protection through a comprehensive fire detection system using a multi-agency approach.
4. Use the BLM approved fire suppression techniques in areas of concern for habitat, cultural resources, threatened and endangered species, the designated ACEC, and rural/wildland interface zones.
5. For fire suppression, follow specific guidance in the Fire Management Action Plan.
6. Determine specific hazard reduction and prescribed fire priorities, including the control of infestations by any noxious or invasive species. Implement control activities within the constraints of the existing budget.

2.3.5.6 **Livestock Grazing**

Objective - A

Provide for continued grazing of domestic livestock (cattle), from March 1 to February 28 on only the withdrawn portion of the Bald Mountain Allotment. The Naquinta Springs allotment, and the remainder of the planning area will remain closed to all livestock grazing.

Management Directions - A

1. Manage the rangeland resource consistent with the phenological and physiological requirements of key perennial species.
2. Ensure forage utilization by livestock is consistent with appropriate Standards and Guidelines and allotment-specific objectives.
3. For perennial forages on the Bald Mountain allotment, provide for increased plant vigor and reproductive capability through livestock grazing management.
4. Maintain static trend or achieve upward trend for key perennial forage species through livestock grazing management.
5. Allow the permitee to place salt and mineral supplements a minimum of one mile from water.

Objective - B

Establish a grazing management system that may include rest rotation, deferred rest rotation, or other management approaches to meet specific resource management objectives.

Management Directions - B

1. Include the availability of water for all resources (e.g., riparian, livestock, and wildlife) as part of any grazing system.
2. Construct rangeland developments, as needed, to create a more uniform distribution of livestock consistent with management objectives.
3. Incorporate appropriate Standards and Guidelines into all livestock use authorizations, grazing systems, and management plans to ensure rangeland health improved or maintained.

Objective - C

Manage allotments open to grazing with the "selective management" approach (i.e., maintenance (M), improve (I), or custodial (C)).

Management Direction - C

Maintain the Bald Mountain Allotment as an "M" category allotment.

2.3.5.7 **Wild Horses**

Alternative B revises the mapped 1971 wild horse herd area, as discussed in Alternative A, to include most of the NTTR North Range, encompassing a total of approximately 1,330,540 acres. This area is identified to be the proposed wild horse herd management area (HMA). Within this HMA, it is proposed to use a smaller area of approximately 474,370 acres within which to calculate the appropriate management level (AML) for the entire HMA.

Objectives - A

Manage for healthy, genetically viable herds of wild horses in a natural, thriving ecological balance with other rangeland resources.

Management Directions - A

1. Restrict the active management of wild horses to the HMA identified in Figure 2-3 as the Herd Management Area.
2. Adjust the AML when monitoring data determine that management objectives for wild horses, vegetation, forage production, water, riparian, and other resources are not being met.
3. Limit forage utilization by all herbivores to 50 percent of the current year's above-ground primary production for key grasses, and 45 percent for key shrubs and forbs. Construct up to seven exclosures to help assess resource conditions.
4. Maintain dependable water sources to allow better distribution of wild horses throughout the core area. Develop three to four water wells in the area identified for determining AML (core area).

Objectives - B

Maintain the wild, free-roaming character of the wild horses on the public lands.

Management Direction - B

Wild horses will be removed when animals permanently reside on lands outside the AML core area (i.e., use is more than seasonal drift), or if the total horse population exceeds the AML for the HMA.

2.3.6 CULTURAL AND HISTORICAL RESOURCES

2.3.6.1 **Objective**

Identify and protect cultural and paleontological resources in conformance with applicable legislation and BLM and Air Force policy and guidance.

2.3.6.2 **Management Direction**

BLM and Nellis will follow specific guidance stated in the Nellis Air Force Base Cultural Resource Management Plan. (Copies available for review at the Las Vegas Field Office, BLM and Nellis Air Force Base)

2.3.7 LAND STATUS, DESIGNATIONS AND USES

2.3.7.1 **Lands Program**

Objective

Lands are not available for disposal within the withdrawn area. Continue to make the withdrawn lands available for land use authorizations.

Management Direction

The Secretary of the Interior may issue a lease, easement, right-of-way, or other authorization with respect to the nonmilitary use of lands only with the concurrence of the Secretary of the Air Force or his designee.

2.3.7.2 **Natural Areas and Areas of Critical Environmental Concern**

Objective

Change the boundary of the Timber Mountain designated ACEC to reflect PL106-65, and protect that ACEC.

Management Direction

Work closely with the Air Force to ensure any changes in management within the Timber Mountain ACEC are fully considered prior to their enactment.

2.3.7.3 **Recreation**

Objective

Continue to allow hunting on the 26-square-mile area on Stonewall Mountain. Access restrictions on the NTTR preclude all other unrestricted recreational opportunities in the planning area.

2.3.7.4 **Wilderness Designations**

The NTTR planning area does not contain any land that meets the minimum criteria for consideration as a wilderness study area. No areas are recommended for management as wilderness. This would be the same as a No-Action Alternative.

2.3.8 WASTE AND MATERIALS MANAGEMENT

2.3.8.1 **Objective**

Prevent hazardous materials contamination and support environmental restoration and groundwater characterization activities.

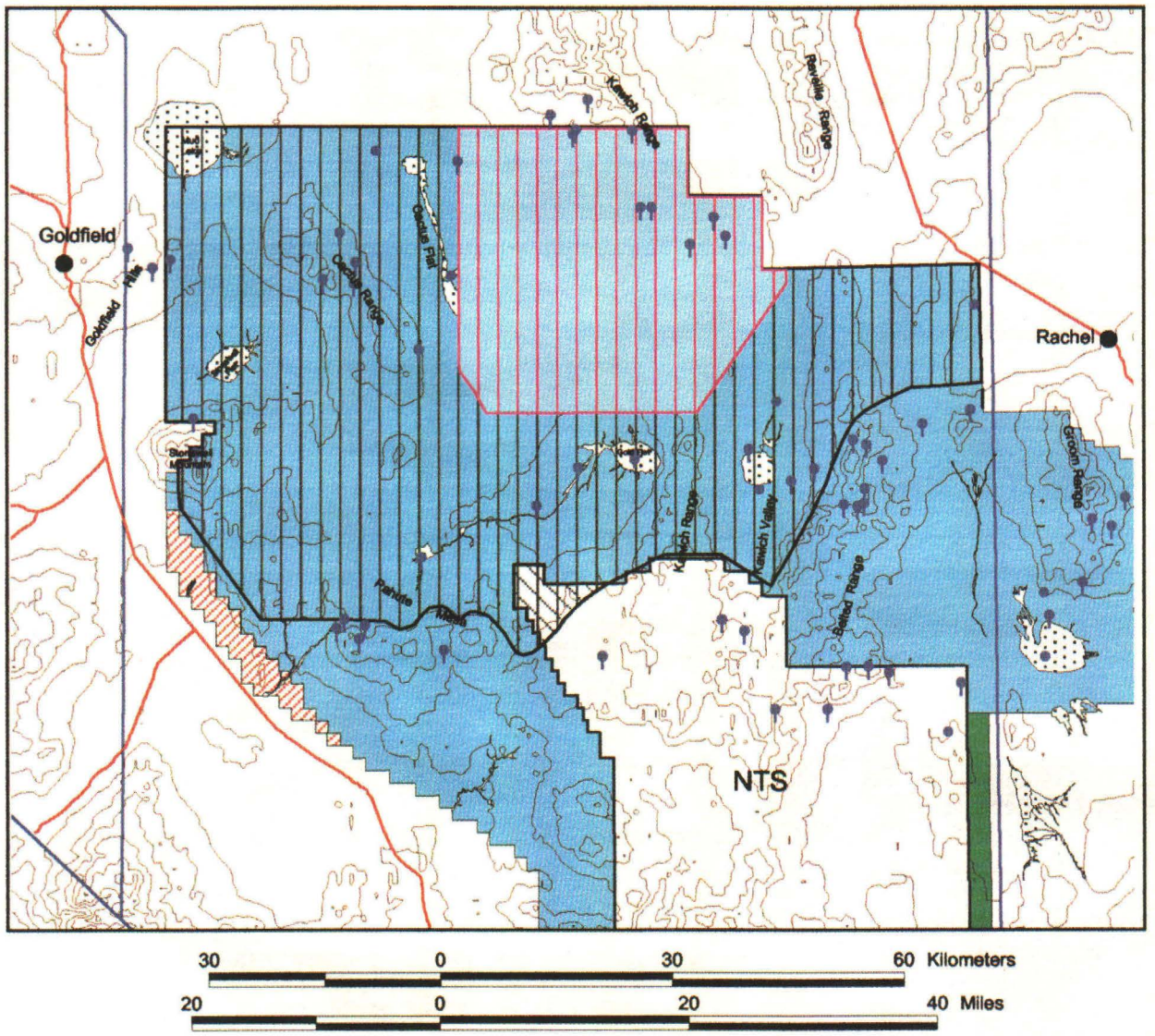
2.3.8.2 **Management Directions**

1. Minimize releases of hazardous materials through compliance with current regulations and existing hazardous waste management plans (a copy of NAFB Plan 12, Hazardous Waste Management Plan is available at the Las Vegas Field Office or through Nellis Air Force Base).
2. Evaluate all actions for hazardous materials, waste minimization and pollution prevention.

2.4 ALTERNATIVE C

Other than for wild horses, all resource management objectives in Alternative C are the same as those for Alternative B. With respect to wild horses, Alternative C represents the area where the Air Force believes wild horses should be managed to minimize conflicts with the Air Force mission. The proposed HMA is a subset of the 1971 HA. This proposed HMA encompasses an area of 325,220 acres (Figure 2-4). Horses would be allowed to move outside the HMA provided they did not establish permanent home ranges outside of the HMA. The Air Force would be able to request BLM removal of horses outside the HMA, and a typical reason for such a request would be the home range issue.

Objectives and management direction for the air, soil, water, and riparian resources that are impacted by other resource programs are included in those program sections. To avoid redundancy, these objectives and management direction are not repeated within the air, soil, water, and riparian sections.



Legend

- Communities
- Major Springs and Reservoirs on the North Range
- Springs
- Reservoirs
- Wild Horse Herd Management Area (HMA) excluding Range 4809A
- 1971 Wild Horse Herd Area
- 1971 Wild Horse Herd Area on DOE Land
- Playas
- Non-renewal Area
- NTS Boundary
- Major Roads and Highways
- County Boundaries
- 200 Meter Contours
- Northern Planning Area
- Southern Planning Area

N

NTTR boundary data obtained from the NTTR Range Management Office.

Figure 2-4. Alternative C. Delineation of reduced wild horse herd management area.

2.4.1 BIOLOGICAL RESOURCES

2.4.1.1. **Wild Horses**

This alternative also revises the mapped 1971 wild horse herd area to include most of the NTTR North Range. However, it is proposed to define a smaller HMA that encompasses a total of approximately 325,220 acres, and this HMA would be used to calculate the AML for the proposed HMA.

Objective - A

Manage for healthy, genetically viable herds of wild horses in a natural, thriving ecological balance with other rangeland uses.

Management Directions - A

1. Manage the area identified in Figure 2-4 as the Herd Management Area..
2. Adjust the AML identified for the HMA when monitoring determines the animal population, forage, water, riparian, and other ecosystem management objectives are not being met.
3. Limit utilization of the current year's production by all herbivores on key perennial forage species within the HMA to 50 percent for grasses and 45 percent for shrubs and forbs. Construct eight or more exclosures to assist in assessment of resource conditions.
4. Develop and maintain dependable water sources to allow more even distribution of wild horses throughout the HMA, but place water to deter animal movement to the Cactus Range. Develop three to four water wells within the HMA.

Objective - B

Maintain the wild, free-roaming character of the wild horses on the withdrawn public lands.

Management Direction - B

1. Remove wild horses when animals are residing on lands outside HMA or when the AML is exceeded.
2. Allow for seasonal movement outside the HMA. If animals remain in place and develop new home range outside the HMA, coordination between the agencies will be taken to remove those animals.

2.5 **ALTERNATIVE D**

As with Alternative C, other than for wild horses, all resource management objectives in Alternative D are the same as those for Alternative B. Alternative D identifies complete removal of wild horses (Figure 2-5). One reason for removal could include poor water quality due to contaminants. Also, it is possible that the management area for wild horses could be changed because of new Air Force mission requirements. An alternative to assess these possibilities is appropriate.

2.5.1 BIOLOGICAL RESOURCES

2.5.1.1. **Wild Horses**

This alternative also revises the mapped 1971 wild horse herd area to include most of the NTTR North Range.

Objective

Do not manage for wild horses on the NTTR.

Management Direction

Remove all wild horses within four years after approval of the plan.

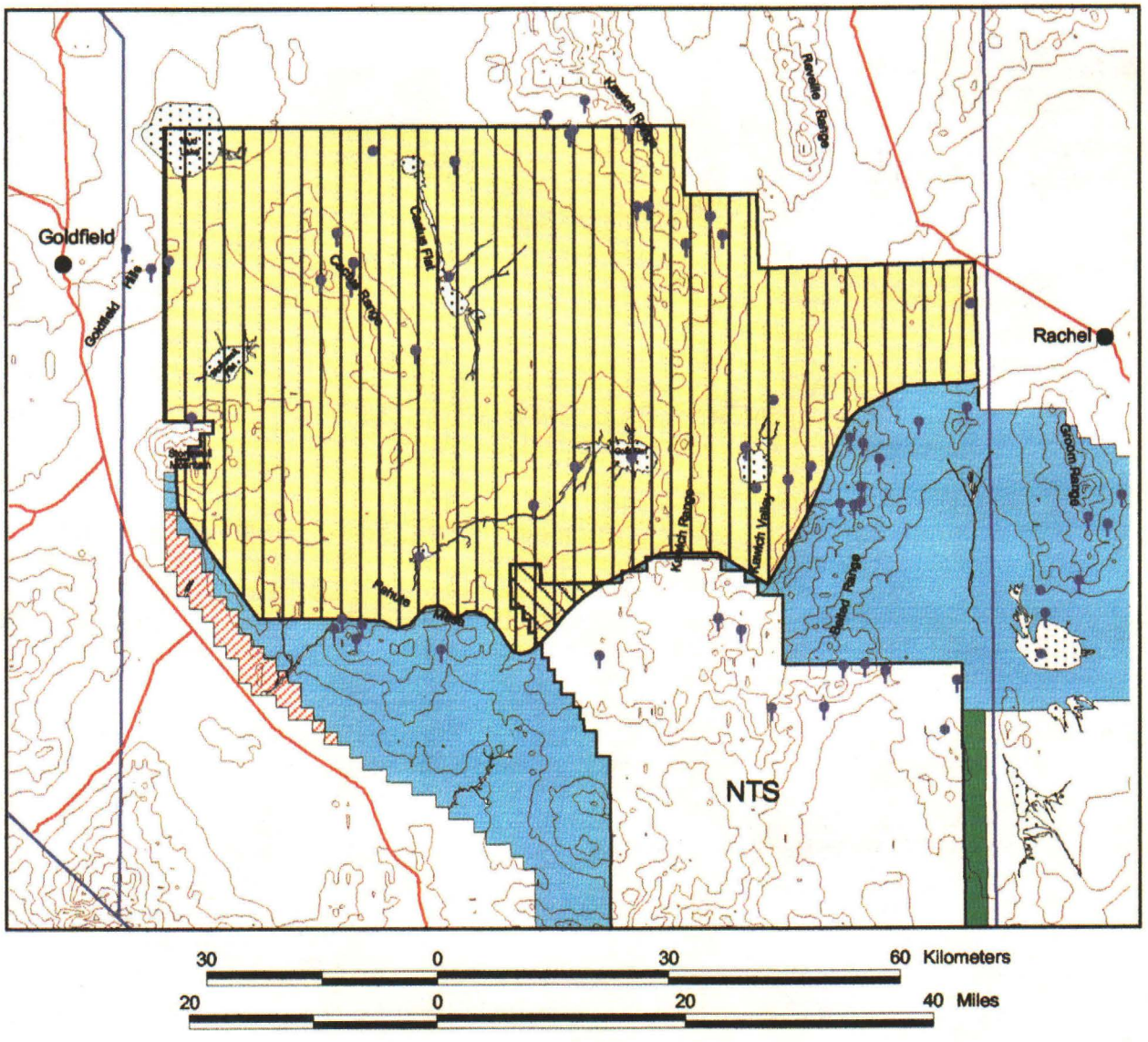


Figure 2-5. Alternative D. Elimination of the wild horse herd in the planning area.

2.6 **ALTERNATIVES DROPPED FROM FURTHER CONSIDERATION**

2.6.1 EXPANDED LIVESTOCK GRAZING

The public identified two areas where they wanted to graze livestock, which were not previously grazed by livestock. Public Law 106-65 specifically states grazing could continue where permitted on the date of enactment of the law. The Air Force indicated that livestock grazing in the areas requested would not be consistent with the military mission. Therefore, this alternative was dropped from further consideration.

THIS PAGE DELIBERATELY LEFT BLANK

CHAPTER 3
DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1 INTRODUCTION

This chapter summarizes the affected environment of the planning area based largely on materials and studies existing at the time of writing. Exceptions include a survey and sampling of all NTTR springs, wells and reservoirs.

3.2 PHYSIOGRAPHY, CLIMATE AND VISUAL RESOURCES

3.2.1 PHYSIOGRAPHY AND TOPOGRAPHY

The NTTR is located within the southern part of the Great Basin, the northernmost sub-province of the Basin and Range physiographic province. The Great Basin sub-province drains internally; precipitation has no surface water outlet to the Pacific Ocean.

The physiography of the NTTR is typical of the Basin and Range province. The north-south trending mountain ranges are separated by broad valleys. The valley bottoms generally have one or more playas that are bounded by alluvial plains (slope 2% or less). Upgradient from the alluvial plains are coalescing fan piedmonts. Individual alluvial fans often develop below ephemeral drainages that emerge from the mountains. The fan piedmonts and alluvial fans are prominent physiographic features, and can attain a slope of up to about 30 percent. The prevailing westerly winds have resulted in sand sheets becoming established on the east and northeast sides of some of the playa lakes. A detailed explanation of the geomorphology of the Basin and Range province can be found in Peterson (1981).

Elevation varies substantially on the NTTR. The valley bottoms of the South Range vary from about 3,000 ft to 3,600 ft, while on the North Range they generally are above 4,500 feet. Except for several small peaks, mountain ranges on the South Range do not exceed 6,000 ft, but on the North Range the mountain tops are between 7,000 ft and 9,000 ft in elevation.

The topography on most of NTTR has not been drastically altered. Local modifications, such as road construction, sand and gravel pits, underground mining, flood-control structures, drainage improvements, airstrips, landfills, fuel staging and storage areas, and explosive ordnance, are widespread. Air Force tactical target complexes and associated infrastructure have created approximately 2,827 miles of linear corridors, and 130,000 acres of disturbed habitat (Figure 3-1). Most of the linear corridors are in the planning area, but the majority of the disturbed acreage is not. It occurs at target impact areas on the South Range, where it overlaps with the DNWR, and is outside the planning area.

3.2.2 CLIMATE

Climate on the NTTR is affected by two primary air movements. From about October through April, air masses from the central and northern Pacific traverse across the Sierra Nevada Mountains and dominate the weather pattern. From about June through September, air masses from Mexico and the Gulf of Mexico typically influence the local weather.

3.2.2.1 **Precipitation**

The amount of annual precipitation is strongly influenced by elevation. Annual averages for the valley bottoms range from about 4 inches on the South Range (Mojave Desert) to about 6 inches on the North Range (Great Basin). Average annual precipitation on alluvial fans varies from about 5 inches on the South Range to 8-10 inches on the North Range. The tallest mountains receive about 12-16 inches of precipitation. Their steep terrain interacts with strong winds to redistribute much of the winter snowfall. Specific sites may receive substantially more, or less, effective precipitation than indicated by average values.

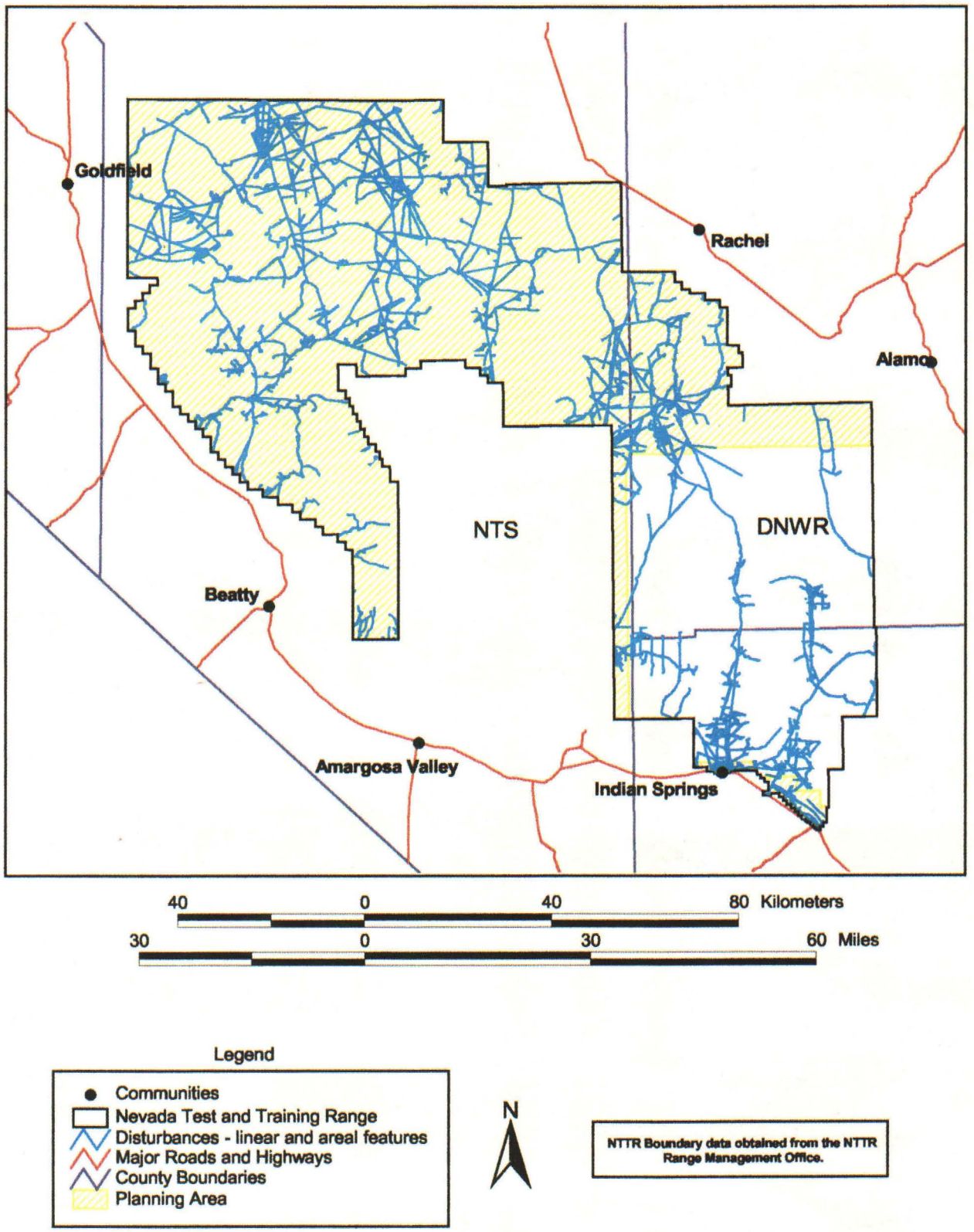


Figure 3-1. Disturbance features on the Nevada Test and Training Range. Linear features include roads, trails, power lines, and communication lines. Area features nclude facilities, training areas, and targets.

Winter precipitation often falls as snow above about 5,000 ft. Lower elevations receive mostly rain, but periodic heavy snowfall (6-12 in) can occur above about 3,000 ft. Winter storms typically are regional events of low to moderate intensity. Intense flood events are uncommon.

Summer rainfall is usually associated with convective thunderstorms, which often produce localized flash flooding. Approximately 15 to 30 thunderstorms occur annually at any given location on the NTTR (NOAA, 1980).

3.2.2.2 **Temperature**

Temperature records on the NTTR are very limited. Data are more common from the small towns that surround the NTTR's perimeter (Table 3-1). The coldest month, on average, is January. Mean low temperatures at almost all areas are below freezing, with many areas having low temperatures in the teens. The extreme low temperatures recorded at most locations are below 0°F, with some areas near the North Range probably reaching -20°F.

The warmest month is July. Mean high temperatures generally range from the low to mid 90s for valley locations on the North Range, to well over 100°F at valley locations on the South Range. Extreme high temperatures on the North Range are between 100°F and 105°F. On the South Range, high temperatures can reach 118°F.

3.2.2.3 **Wind**

Average annual wind speed varies with elevation (DOE, 1996). At high elevations, the average wind speed is about 10 mph. At lower elevations, the wind speed is less, averaging about 7-8 mph. The prevailing wind direction varies by season. In the winter, winds are generally from the north-northeast. During the summer, winds are commonly from the south-southwest. Severe winds are common during storm events, with gusts potentially reaching 100 mph.

3.2.2.4 **Relative humidity**

The arid conditions result in low relative humidity. Early morning values average about 58 percent. Afternoon values decrease to about 25 percent (BLM, 1981). Lower values often occur during the summer months.

Table 3-1. Temperature records for official weather stations located around the perimeter of the NTTR. Data are from the Western Regional Climate Center. All temperature values are in °F.

Location	Elevation	Period of Record	Mean Jan Minimum	Mean July Maximum	Record High	Record Low
Desert Nat'l Wildlife Range		1948-2000	29.1	101.7	115	0
Indian Springs		1948-1964	21.8	104.0	118	-5
Desert Rock		1984-2000	32.8	98.2	112	6
Beatty		1948-1972	27.2	99.8	114	7
Beatty North		1972-2000	29.0	96.6	112	2
Sarcobatus		1948-1961	19.9	98.4	111	-5
Goldfield		1948-2000	21.2	88.8	100	-15
Tonopah airport		1954-2000	18.7	91.1	104	-15
Penoyer Valley		1967-2000	14.2	91.8	104	-21
Key Pitman		1964-1989	23.9	96.0	110	-3
Alamo		1948-1962	20.1	100.3	111	-3
Pahranagat Wildlife Refuge		1964-2000	27.0	97.9	112	-1

3.2.3 VISUAL RESOURCES

Visual resources are the natural (landforms, viewscapes, water bodies, vegetation) and man-made (buildings, fences, signs) features that give a particular environment its aesthetic characteristics. A visual impression of an area is derived from the type, physical arrangement, and contrast between these features. Although each viewer's perception may be slightly different, an overall landscape character can be assigned to an area and impacts to that character can be assessed.

When rating the visual character of an area, the shape, form, line, and color of the landscape are important. The BLM uses the Visual Resource Management Classification (VRM) system (BLM, 1986) to identify the existing visual character of the landscape and define the allowable extent and type of modification to the landscape. The VRM system rates visual character from the most sensitive (VRM Class I) to the least sensitive (VRM Class IV). Visual classes are defined solely by the quality of visual resources of an area and are not influenced by classifications of neighboring areas. The most sensitive class (VRM I) can be adjacent to the least sensitive class (VRM IV). The objectives of these classifications as listed in BLM, 1986 are as follows:

VRM I: The objective of this class to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.

VRM II: The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be very low. Management activities may be seen, but should not attract attention of the casual observer. Any changes must repeat the basic elements of form, line, color, and texture found in the predominant natural features of the characteristic landscape.

VRM III: The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.

VRM IV: The objective of this class is to provide for management activities which may require major modification of the existing character of the landscape. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance, and repeating the basic elements.

In the valleys, local landforms consist of playas, alluvial plains and fans, fan piedmonts, small hills, drainages, and occasional volcanic rock formations. In the mountains, landforms are largely mountain valley fans, mountain sideslopes, ridgelines, rock scree slopes, rock outcrops, and deep canyons. Vegetation in the broad valleys on the southern planning area is Mojave Desert shrublands. In the northern planning area, valleys are largely short-statured shrubs of Great Basin origin. The mountains have a mix of shrub-grass and pinyon-juniper woodland vegetation.

All landforms in the planning area have high sensitivity for American Indians. The ability to see the land without the distraction of buildings, towers, cables, roads, and other objects is essential for the spiritual interaction between Indian people and their traditional lands (AIWS, 1997). The Consolidated Group of Tribes and Organizations recognizes that while the military land withdrawal limits their access to and view of traditional cultural resource properties, it also protects these resources from disturbance by recreafionists.

3.3 AIR RESOURCES

The meteorological potential for air pollution can be quantitatively assessed using Holzworth's (1972) studies. Mixing heights average about 1,100 ft in the morning and 8,000 ft in the afternoon. Wind speeds range from about 9 to 11 mph in the morning, to about 11 to 13 mph in the afternoon. The variable terrain over the planning area, however, can result in significant deviations from average values. Solar insolation throughout the year is moderate to strong, creating slightly to moderately unstable atmospheric conditions between the midmorning and late afternoon hours. Atmospheric stability becomes neutral in the early evening. Dispersion characteristics generally are fair to good. The highest potential for poor dispersion exists in the valleys from December through February, because of persistent surface-based temperature inversions (BLM, 1981). The atmospheric conditions in each valley must be considered individually, to correctly characterize the local and regional situation. A portion of the southern planning area falls within the Clark County air quality non-attainment area for CO and PM10.

3.4 GEOLOGY, MINERAL RESOURCES AND SOILS

3.4.1 GEOLOGY

The NTTR can be divided into two broad geologic regions. The northwestern area is mainly volcanic rocks of late Cenozoic age, and the southeastern area is largely Paleozoic sedimentary rocks (USAF, 1997h).

Exposed rock formations (or units) range from Precambrian (older than 570 million years before present (bp) to Quaternary (less than 1.6 million years bp.). Quaternary alluvium and lower Tertiary volcanic rocks occur in and near the valleys as relatively large, irregular-shaped outcrops. The older Precambrian strata are primarily mixed clastic and carbonate rocks, and occur in the mountains as smaller, scattered, isolated outcrops. This distribution of rocks at the earth's surface is a function of covering from both volcanism and alluvial deposition, and also extensive fragmentation of the older rocks, from multiple mountain-building events (USAF, 1994a).

Geologic strata on the NTTR represent many depositional environments and time periods. Upper Precambrian and Lower Cambrian strata (550 to 650 million years bp) typically are mixed clastic sediments (sandstone and shale) and carbonates (limestone), with some metasedimentary rocks (quartzite and chert). The remainder of the Paleozoic section (245 to 550 million years bp) includes a similar mix of rock types, with scattered volcanics occurring in the lower portion. There are few Mesozoic rocks (66 to 245 million years bp). Lower Tertiary strata (Eocene, Oligocene, and Miocene), which range in age from 5 to 58 million years bp, are dominated by volcanics, whereas mixed sediments are generally present in the upper Tertiary sequence (Pliocene — 1.6 to 5.3 million years bp). Quaternary sediments generally are unconsolidated debris shed from the erosion of neighboring mountains (USAF, 1994a).

Tertiary volcanic rocks dominate the geology of the North Range. The Timber Mountain caldera is one of several large centers of prehistoric volcanic activity (Byers et al., 1976; Huber, 1988). Other volcanic centers include Black Mountain, the Cactus Range, Silent Canyon calderas, and the Mount Helen dome. Welded and air-fall tuff, derived from these volcanic centers, extend throughout the North Range, including the extensive tableland that forms western Pahute Mesa, the southern Cactus and Kawich ranges, and Stonewall Mountain (Cornwall, 1972; USAF, 1997h).

The mountains on the South Range are dominated by Paleozoic carbonate rocks, with lesser amounts of quartzite, sandstone, and shale. The valleys have thick deposits of late Tertiary and Quaternary alluvium derived from erosion of adjacent mountain ranges. Lacustrine and fluvial sedimentary rocks, deposited in shallow basins between the middle and late Tertiary, crop out in several areas, particularly in the southern Spotted Range, the Pintwater Range, and the Desert Range. Older Tertiary valley-fill sediments, uplifted with the underlying Paleozoic bedrock, are locally exposed on the flanks of some mountains (Longwell et al., 1965; USAF, 1997h). Two general groups of volcanic rocks are recognized: (1) an older, late Oligocene-early Miocene sequence of ash-flow

tuffs and related lavas erupted from volcanic centers within and to the north of NTTR (Best et al., 1989; Ekren et al., 1971); and (2) middle- and late-Miocene ash-flow tuffs and lavas erupted from volcanic centers of the southwestern Nevada volcanic field (Byers et al., 1976; 1989; Noble et al., 1991; Sawyer et al., 1994).

Hydrothermal alteration and associated mineralization have affected rocks throughout the NTTR. Many areas of alteration appear to be related to magmatism (mainly middle to late Tertiary) associated with caldera margins, or centers of silicic to intermediate volcanic and shallow subvolcanic rocks (USAF,1997h). Hydrothermally altered sites often support unique plant communities, and/or sensitive species (Bair, 1998; Billings, 1950).

3.4.2 MINERAL RESOURCES

3.4.2.1 **Mineral Use and Development**

Construction Aggregate (sand and gravel, crushed stone)

The region in and around the NTTR contains vast resources of sand and gravel, and large amounts of material suitable for the production of high-quality crushed stone.

A large amount of sand and gravel is located in the valleys on the North Range, particularly on the alluvial fans. Some deposits, however, have deleterious materials such as clay minerals and reactive silica.

On the South Range, large amounts of sand and gravel derived from Paleozoic carbonate highlands (one of the preferred construction aggregate materials in Las Vegas) are available in alluvial fans along Highway 95. In this same area, there are large exposures of Paleozoic carbonate rock (used in crushed stone in Las Vegas).

Two deposits of volcanic cinder are located near the southwestern boundary of the NTTR. The largest (1,950 ft diameter) forms an asymmetrical cone on the north side of Sleeping Butte. It is composed of reddish-brown to black, lightweight scoria. The second deposit is near Sleeping Butte, and contains similar cinder types for color, density, and particle size.

Borrow Pits

Aggregate has been mined from alluvial material near the airfield on the Tonopah Test Range. Pit run material was crushed and screened for use in base fill, and was used in concrete produced in a nearby batch plant. Problems with quality were encountered with Portland cement and asphalt concrete produced from this aggregate (Bryan and Vineis, 1983), and since 1983 the material has only been used as fill (Dennis Bryan, NBMG, personal communication, 1996). Aggregate for concrete to construct facilities in the northern planning area has come from outside the NTTR (Bryan, NBMG, personal communication, 1996).

Sand and gravel have been mined at several sites on the NTTR, for use as fill materials. Borrow pits include the previously mentioned one near the airfield, and from pits located near the housing and industrial parts of the Tonopah Test Range (Tingley and Papke, 1987). Borrow pits are also located near the Tolicha Operation Center and near Sleeping Butte.

Constraints to Development

Although the NTTR probably contains large amounts of material that would be suitable for construction aggregate, under current market conditions, aggregate production from the NTTR is not economically competitive due to high haulage costs. Future marketing and political changes in the Las Vegas area may make sand and gravel, and crushed stone from the NTTR more attractive economically. In addition, increased construction activity in areas U.S. Highway 95, as well as new construction in the NTTR, could make construction aggregate production in the NTTR economically feasible.

The cinder cone deposits near Sleeping Butte and Little Black Peak are only 3 to 4 miles from U.S. Highway 95; however, they are more than 140 miles by road from the Las Vegas market area. In the short term, these deposits have only moderate potential as a source of lightweight construction aggregate because of the long haul distance to Las Vegas, and the presence of more advantageously located deposits elsewhere in the region.

3.4.2.2 **Mining Districts and Areas**

Prospecting and mining within the boundaries of the NTTR began in the late 1860s and continued unrestricted until 1942. Mining occurred throughout the NTTR, but most activity focused on the North Range. All or part of some 25 major mining districts and areas are within the NTTR, with 13 additional smaller prospecting areas identified by the Nevada Bureau of Mines and Geology (USAF, 1997h).

Within the planning area, mineral discoveries were made in the Groom district in 1864 and in the Southeastern district in about 1870. Prospecting activity on the west side of the NTTR study area exploded following the discovery of the rich silver and gold deposits at Tonopah (1900) and Goldfield (1902). Claims were staked on turquoise and gold discoveries near Cactus Peak, in the Cactus Springs district, and in the Antelope Springs district from 1901 through 1903. Precious metal discoveries were made at Silverbow, Wellington, Trappmans, and Wilsons camps in 1904, at Gold Reed, Tolicha (Quartz Mountain) and Gold Crater in 1905, at Transvaal in 1906; and at Jamestown in 1907-08. The Silverbow district steadily produced ore most of the years from its discovery until closure of the planning area in 1942. Mining districts in the Cactus Range did not have a "boom" period. Rather individuals who made the initial discoveries continued to prospect and develop mines for several decades. In the southeastern part of the NTTR, the Groom district produced lead-silver-copper ore from 1869 to 1874, lapsed until 1915, then produced ore steadily through 1956. The Groom district had the greatest production, both in tons of ore produced and in value of ore, within the planning area.

Production for mining districts within the NTTR study area is summarized in USAF (1997h). Production figures have been compiled from U.S. Bureau of Mines records for the years 1902-69, augmented by data from unpublished reports in NBMG files and from contemporary newspaper articles.

3.4.2.3 **Metallic Minerals**

An identified resource is one whose location, grade, quality, and quantity are known or can be estimated from specific geologic evidence. One mining area within the NTTR may contain an identified metallic mineral resource. A small tonnage of gold-silver-bearing material, defined by old mine maps and assays, may be present in the Antelope View Mine, Antelope Springs district (USAF, 1997h). Historic mine production on the NTTR is presented in Appendix B.

Locations favorable for the discovery and development of potential metallic resources have been defined throughout the NTTR (USAF, 1997h). These locations, grouped into seven generalized areas within which specific mining districts and mining areas with resource potential occur, are described in USAF (1997h).

Gold and Silver

Areas favorable for the discovery and development of precious metal resources are concentrated on the North Range. Stream sediment sampling and reconnaissance geologic evaluation outlined large areas of the Cactus Range, the area around Mount Helen, parts of Pahute Mesa, much of the Kawich Range, and areas of the Belted Range as favorable for deposits of precious metals. On the South Range, areas favorable for precious metals are in the Papoose and Pintwater ranges.

Base Metals

Areas favorable for discovery and development of copper, molybdenum, lead, zinc, mercury, and tungsten occur within the NTTR. Significant portions of the Cactus Range and the Mount Helen area have potential for producing porphyry copper and/or molybdenum. These are coincident with areas favorable for gold. Areas favorable for deposits of lead and zinc with associated silver are found in the Papoose and Pintwater ranges. Mercury potential is defined in the Kawich Range, and in an area northwest of Yucca Mountain. Areas of base metals favorability are shown in USAF (1997h).

3.4.3 SOILS

Soils in the planning area have not been mapped in detail. General descriptions of soil series likely to occur in the planning area are available from the U.S. Department of Agriculture (USDA), Natural Resource Conservation Service. Soils data are also available from cultural resource surveys conducted in the planning area (e.g., Dames & Moore, 1995) and from geologic studies in adjacent areas (Quade et al., 1995). Soil data collected outside the NTTR can be extrapolated to the NTTR, when the geology, topography, geomorphology, climate, and vegetation on and off the NTTR are similar.

Soils in the southern planning area are aridisols developed in carbonate parent material, usually with weak, vesicular A horizons, strong cumulic B horizons, and moderate to well developed C horizons (depending on the age of the parent sediment). Strongly developed carbonate soil morphologies occur where major washes are entrenched into alluvial fans (NRCS, USDA as reported in USAF, 1997a).

On the northern planning area, soils at lower elevations are typically entisols and aridisols. Entisols are most common where sand sheets have been deposited above playa landforms. Mollisols are common in the mountains, at higher elevations. A horizons typically are better developed because more moisture is present. The presence of volcanic parent materials often results in greater clay content. These soils typically consist of a noticeable organic component in relatively dense scrub and woodland habitats. Similar to the South Range, B horizons in the North Range have a cumulic character due to the influx of eolian silt and clay-sized particles during the Quaternary period. Carbonate horizons are commonly developed in older parent material, with most carbonate material originating from eolian dust (Air Force, 1997a).

A consequence of nuclear testing and aerial bombing has been soil contamination. Pockets of radioactive contamination surround each test (DOE, 1996). Ordnance residues (e.g. napalm, fuel-air explosives, white phosphorus) have contaminated soils in the vicinity of bombing targets (USAF, 1996a). In addition, soil contamination has been identified on the NTTR from operations and maintenance spills (primarily fuels, oils, etc.). The affected areas are restricted to industrial complexes, electronic warfare sites, and target areas, with most of the spills covering small spatial areas (tens of square feet). See the Section titled Hazardous Materials for further discussion.

3.5 **HYDROLOGY AND WATER RESOURCES**

3.5.1 SURFACE WATER

3.5.1.1 **Watersheds of the NTTR**

Most of the NTTR lies within the Great Basin hydrographic region; a small portion of the southern edge is within the Colorado River drainage. Within the Great Basin hydrographic region, runoff due to storm events typically infiltrates below the ground surface in low-lying areas or is collected in playa lakes, where it evaporates.

3.5.1.2 **Watershed Features**

Figure 3-2 shows schematically some of the prominent features of the arid hydrologic environment, these being: (1) alluvial fans; (2) valley collectors; and (3) dry lake beds (playa lakes). Also shown in Figure 3-2, is a road alignment crossing the alluvial fan system. Roads and

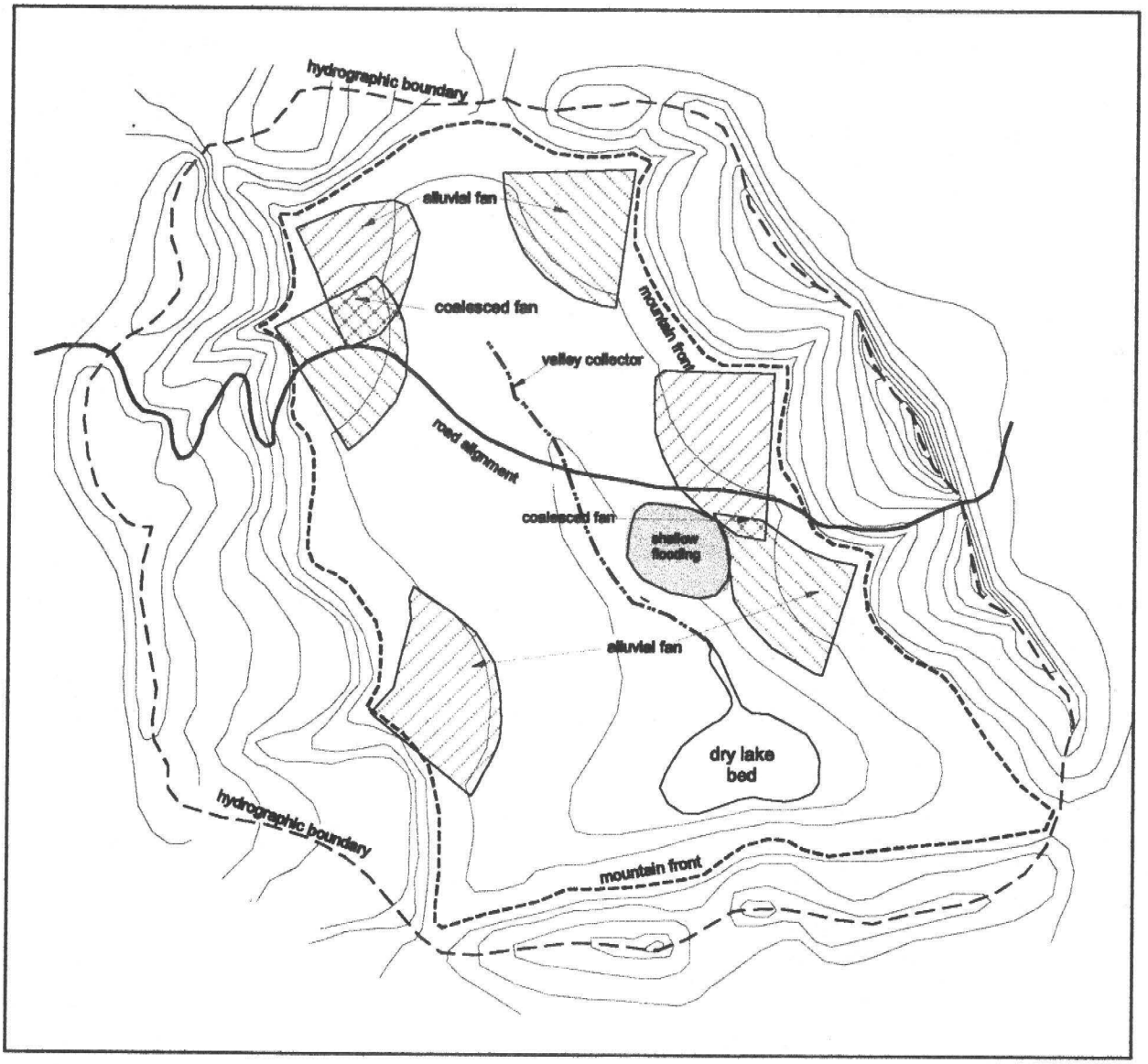


Figure 3-2. Schematic diagram of the prominent hydrologic features in arid environments.

other linear infrastructure alignments can intercept, concentrate, and divert flood flows. This often results in erosion and the movement of flood hazard from one location to another.

Alluvial Fans

At the base of the mountain front alluvial fans are usually present (Figure 3-2). According to the Federal Emergency Management Agency (FEMA), flooding on active alluvial fans is characterized by high-velocity flows; active processes of erosion, sediment transport, and deposition; and unpredictable flowpaths. Flooding in the upper portion of the active alluvial fan is usually confined to a single channel, and in the lower portions the flow may be conveyed in multiple channels.

Progressing downslope from the mountain front, an area where multiple alluvial fans join and grow together (coalesce) is reached. Flooding on the coalesced alluvial fan system may take place in multiple channels and the channels may be distributary. Moving further downslope the longitudinal slope greatly decreases; and in this area, shallow flooding may occur. According to FEMA shallow flooding conditions are defined as flooding that is limited to 3.0 feet or less in depth where no defined channel exists. In Figure 3-2, areas where shallow flooding may occur are indicated.

Valley Collectors

At the bottom of the alluvial fan system, there typically in the bottom of the valley may be a channel, termed a valley collector (Figure 3-2). This channel collects and transmits the flow from several systems of alluvial fans to either a topographic outlet or to a playa lake, or dry lake bed. Table 3-2 presents a list of the identified valley collector watersheds within the NTTR. Figure 3-3 provides a delineation of the hydrographic basins within which these watersheds are located.

Valley collectors are important in supporting the area's ecosystem. Although the valley collector stream channels are dry a significant portion of the year, the valley collectors tend to show higher densities of vegetation near their banks. Vegetation is supported because of infiltration of water in the channel beds when flows occur. Vegetation can utilize the vadose zone water to support growth for an extended period of time relative to the surrounding landscape. This vegetation may in turn provide an enhanced habitat for the area's fauna.

Dry Lake Beds

Dry lake beds (Figure 3-2) are typically at the lowest elevation within their surrounding watersheds, and have large surface areas relative to the potential volume of water that could be stored in the lakes. During, or immediately following storm events, dry lakebeds receive water from direct precipitation on the lakebed, and/or from stream channels that drain surrounding uplands. As discussed earlier, the climate within the NTTR is characterized by low precipitation and high potential evapotranspiration. The dry lakebeds tend to hold water either during or directly after precipitation events, after which the evaporation of water from the lake's surface dries the lakebeds fairly rapidly. The inflow from stream channels that drain to the lakebeds tends to carry sediments and dissolved solids. These sediments remain in the lakebeds after the water has evaporated, resulting in a barren terrestrial surface that is uninhabitable for vegetation. However, these lakebeds have been shown to be important for migratory bird populations. They can provide a food source (e.g., brine shrimp) when inundated.

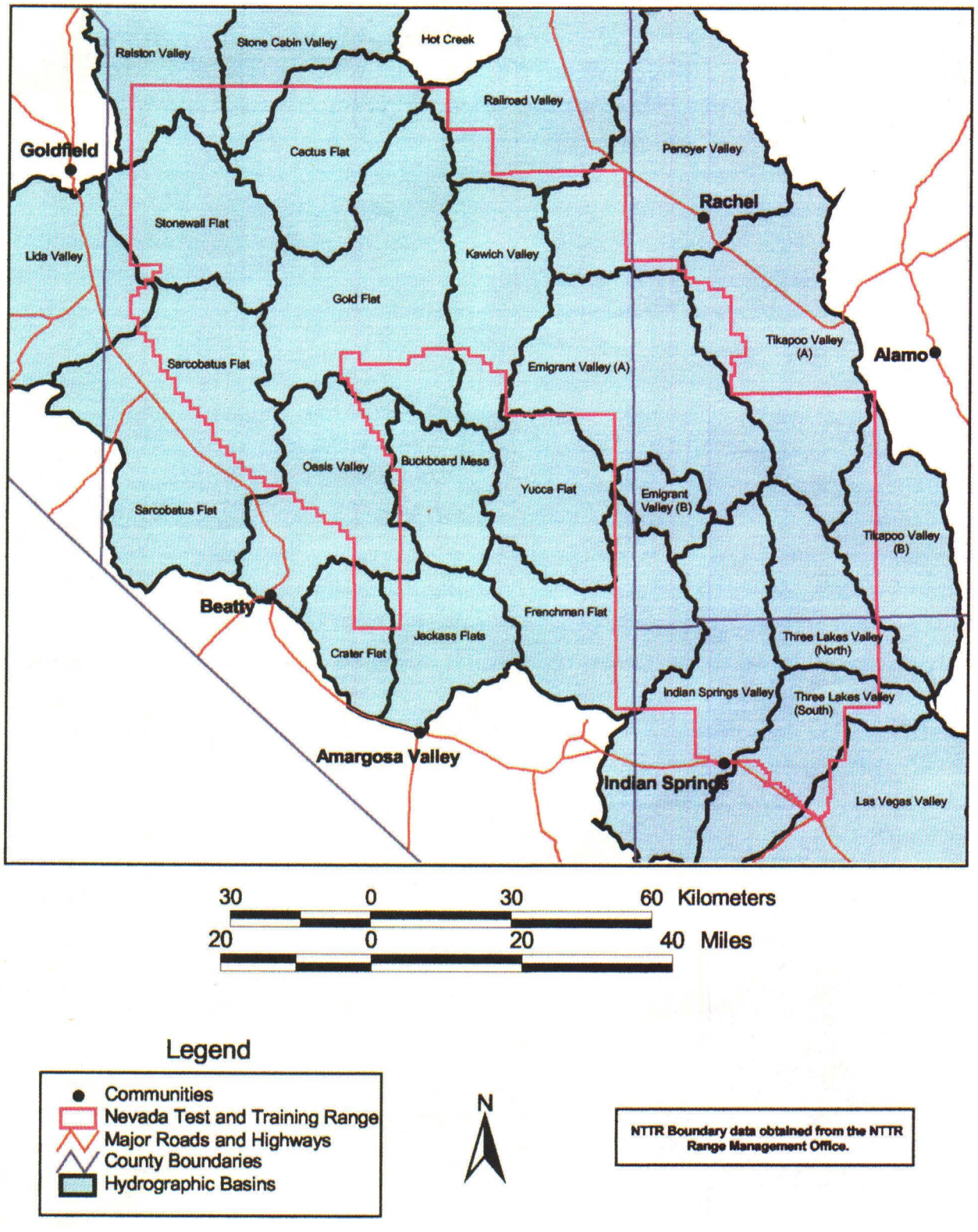


Figure 3-3. Hydrographic Basins of the Nevada Test and Training Range.

Table 3-2. Valley collector drainage areas of the Nevada Test and Training Range (USAF, 1997b).

Collector Watershed Designation :	Drainage Area: (Sq mi):	Collector Watershed : Designation :	Drainage Area (Sq mi)
A : Ralston Valley:		L : Emigrant Valley:	
A-1:	109	L-1:	75
C : Cactus Flat:		L-3/L-4:	43
C-1:	60	L-5:	38
C-2:	30	L-6:	87
C-3:	52	L-7:	4
C-4:	60	L-8:	38
E : Stonewall Flat:		L-9:	49
E-1/E-2:	206	N : Oasis Valley	
E-3:	33	N-1:	208
E-4	30	Q : Papoose Lake Valley	
E-5:	35	Q-1:	6
F : Gold Flat:		Q-2:	31
F-1:	29	Q-3:	40
F-2:	21	S : Frenchman Flat	
F-3:	349	S-2	63
F-4:	68	S-4	50
F-8:	38	T : Indian Springs Valley	
F-9:	179	T-1	59
G - Kawich Valley:		T-2	203
G-1:	119	T-3	5
G-2:	32	U : Three Lakes Valley North	
K : Sarcobatus Flat:		U-2	53
K-1:	140	U-3:	32
K-2:	85	V: Three Lakes Valley South	
		V-1	66

Table 3-3. Dry lakebed drainage areas (as reported in USAF, 1997b).

Dry Lakebed Watershed Name:	Watershed Area (mi^2)
Ralston Valley	975
Cactus Flat -- Total	392
Antelope Lake	(255)
Northern Lake	(137)
Stonewall Flat	348
Gold Flat	689
Kawich Valley	361
Emigrant Valley	716
Papoose Lake Valley	100
Frenchman Flat	465
Indian Springs Valley	658
Three Lakes Valley North	304
Three Lakes Valley South	347

There are few facilities constructed on the dry lakebeds, but the flood hazard associated with playa (terminal) lakes must be considered and evaluated.

In a previous study (USAF, 1997b), a total of 11 hydrographic basins were identified that contained drylake beds within the NTTR. The areas of these hydrographic basins ranged from 99 to 971 square miles. The names of the lakebeds, and their respective watershed areas are summarized in Table 3-3.

Estimates of the peak runoff volume (peak inundation volume) for each of these dry lakes were made in USAF, 1997b. These estimates are of limited use for flood hazard assessment on the playa lakebed at the current time. No monitoring data or inundation-duration-frequency relationships have been developed for any of the dry lakes within the NTTR.

3.5.1.3 **Watershed Protection**

There are no known monitoring programs for the quantity and/or quality of surface waters in the planning area. Also, there are no streams or channels in the planning area that are on the Nevada 303d list; therefore, none are considered impaired by specific pollutants. The new TMDL rules developed by the EPA, however, can result in water bodies becoming listed due to pollution, rather than specific pollutants. Pollution can include flow impediments, diversions, or any other condition in a watershed that is not directly related to the discharge of a specific pollutant, but which inhibits a channel from conducting its proper ecological function. The absence of a surface water quality monitoring program results in the absence of baseline data for comparison.

3.5.1.4 **Floodplains and Flood Hazard**

Flood hazard analyses were performed during preparation of the EIS for renewal of the land withdrawal for the NTTR using non-traditional approaches. From the viewpoint of natural resources management, there is little reason to: 1) evaluate flood hazard over the whole range complex; or 2) not to use standard and approved methods to identify flood hazards.

Flooding is an episodic, but important process in arid environments. It has numerous potential effects on the environment and management of natural resources. Severe gullying took place in the southwestern United States in about 1850 and overgrazing of the lands is usually blamed. The actual causes likely included perturbations in the relative frequency of precipitation that weakened the vegetation to the point where grazing, such as that represented by the wild horse herds on NTTR, triggered the gullying process (Leopold, 1951).

Roads, power lines, pipe lines, and buried communication infrastructure all create linear features that can become preferred flowpaths and result in erosion. Accelerated erosion not only causes environmental damage, but can also damage or destroy substantial amounts of infrastructure. Linear features can also serve to collect, concentrate, and divert flood water from one watershed to another.

3.5.2 GROUNDWATER

3.5.2.1 **Hydrogeology**

Groundwater beneath the NTTR, occurs in all rock types, but is most common in basin-fill, carbonate, and volcanic rocks. Other types of rock generally transmit only small quantities of water, and act as barriers to large-scale water movement.

The basin-fill material originated as sediment that eroded from the adjacent mountains during large runoff events, and was deposited in the valley bottoms. Sediment depth can reach thousands of feet thick near the center of the valleys. Most water wells are completed in basin-fill materials and are the most important water supply source in the planning area.

Bedrock geology is located both in the mountain ranges adjacent to the valleys, and beneath the basin-fill sediments. Bedrock in the region is from a variety of rock types including carbonate, volcanic, quartzite, and others. The carbonate rock forms an important, though complicated, aquifer due to its extensive distribution, high transmission capacity, and considerable faulting. Because carbonate rocks extend beneath the locally confined basin-fill aquifers, groundwater can be transported hundreds of miles from the point of infiltration to the point of discharge.

Volcanic rock is the third principal groundwater source. Its transmission capability varies locally, limiting the importance of volcanic rock aquifers. Volcanic rock systems that are well fractured over extensive areas can develop small regional flow systems.

3.5.2.2 **Groundwater Flow Systems**

Investigations (Harrill et al., 1988; Prudic et al., 1995) of groundwater flow in Nevada have delineated two regional flow systems beneath the NTTR. These are the Colorado River and Death Valley regional systems. Most of the planning area overlies the Pahrump-Ash Meadows sub-region, of the Death Valley regional flow system. Recharge flows to the southwest, with discharge occurring at points in Sarcobatus Flat, Oasis Valley, and Ash Meadows, or ultimately to Death Valley. Prudic et al. (1995) indicate that groundwater beneath the extreme northeastern and eastern edge of the NTTR flows into the Colorado River regional flow system and ultimately discharges to the Colorado River.

3.5.2.3 **Groundwater Recharge and Discharge**

Infiltrated precipitation that is not discharged at springs becomes recharge to the basin-fill and regional aquifers. Most precipitation falls on the mountain ranges, thus, most recharge is through bedrock in the mountains, or into basin-fill sediments along runoff channels. Prudic et al (1995) estimate recharge to the Pahrump-Ash Meadows sub-region to be approximately 60,000 acre-ft/year, 17 percent coming from mountain ranges on the NTTR. They estimate recharge to the Penoyer sub-region from the Pahrump-Ash Meadows sub-region to be about 11,000 acre-ft/year. Groundwater flow systems underlying the NTTR together with the estimated recharge to each are shown in Table 3-4.

No natural discharge areas for regional flow systems are located within the NTTR (Prudic et al, 1995). Springs on the NTTR are situated within the mountain blocks, or less frequently, near the surficial contact between the basin-fill sediments and bedrock of the mountain block. Catchments that extend into the mountains supply these springs. Thus, springs receive water before it has recharged the regional or basin-fill flow systems.

3.5.3 WATER RESOURCES

Due to the arid/semi-arid climate of the planning area, ephemeral water features dominate the landscape. One short stream (Breen Creek) and numerous springs are the only free-flowing perennial water sources in the planning area. Groundwater pumping supports several man-made ponds.

A field reconnaissance of surface and underground water sources on the range was made to confirm their locations, and to obtain water samples for chemistry analysis (see Appendix C, Tables B-1, B-2, B-3 and B-4). Available data for water source locations were obtained from water-use permits on file with the Nevada Division of Water Resources, from computer files of the Range Management GIS Office, and from topographic maps published by the U.S. Geological Survey. Location data from permit applications often are wrong because cadastral survey coordinates were projected into unsurveyed areas. Many of the GIS locations were developed from the permit locations and, therefore, are also in error.

Table 3-4. Regional flow system recharge (1,000 acre-ft/year) within the NTTR. Data are from the NTTR withdrawal Draft Environmental Impact Statement (USAF, 1998b; USAF, 1999).

Regional System	Death Valley	Colorado River	
Sub-regional System	Pahrump-Ash Meadows	Penoyer Valley	White River
Mountain Range			
Cactus	1		
Kawich	1	2	
Belted	3	2	
Groom			2
Pahute Mesa	3		
Spotted	1		
Pintwater	1		2
Desert			3
Total	10	4	7

3.5.3.1 **Water Sources**

Streams

Breen Creek is on the west side of the Kawich Range. Perennial flow in Breen Creek historically has been described as reaching a distance of approximately 3.5 miles (Ball, 1909); but in a spring 2001 survey water flowed for only about 2 miles (personal communication, BLM hydrologist Jack Norman, June 2001). Flow in the creek varies throughout the day due to evapotranspiration demands. Storm flow in the creek can reach Antelope Lake Playa, approximately 19 mi from its origin.

Springs

Springs are present in most mountain ranges of the NTTR, with maps and reports identifying as many 113, of which 84 are in the planning area. Two NTTR mountain ranges the Spotted Range and the Desert Range have no reported springs. Both ranges are on the NTTR South Range. There are no springs in the southern planning area. Field visits to the mapped spring locations on the NTTR in the planning area found 64 springs or seeps(Appendix C, Table C-1). The remaining 18 mapped springs either could not be accessed, or no spring was found at the mapped location. The largest concentrations of springs are in the Kawich Range and Groom Range. These are the tallest ranges on the NTTR and receive relatively more precipitation than other mountain ranges.

Most of the springs in the Cactus Range, and Wild Horse Spring in the Goldfield Hills, have been fenced to prevent access by wild horses. None of these springs had water piped outside the exclosures. The exclosure at Cactus Spring was the only one with a gate left open to allow horses access to the water. Some of the springs, during some years (or months of the year) may discharge sufficient quantities of water for water to flow outside the exclosure. The extent to which this happens is unknown.

Field chemistry measurements and water samples were obtained from springs where sufficient discharge was observed. Appendix C, Table C-4 presents the chemistry data available at the time of writing.

Supported Ponds and Runoff Catchment Reservoirs

Several water production wells have a small reservoir adjacent to them, and are designed to supply water for remote construction activity and fire suppression. Ponds are present at the Sandia 6 (Main) well, the Roller Coaster (Sandia 8) well, and the Cedar Pass (Operation & Maintenance) well, and at Tolicha Peak Electronic Combat Range (TPECR). These reservoirs often have small riparian areas that are used by wildlife. All three ponds are fenced to limit access by larger mammals.

There are 12 man-made runoff catchment reservoirs that were found in the planning area (see Appendix C, Table C-2). They appear to be more common in those valleys with fewer natural springs. With only a few exceptions, the reservoirs have been constructed in natural drainages or on the valley playa. Many of these reservoirs are permitted as water sources by the Nevada Division of Water Resources. The small man-made reservoirs generally are shallow, bermed excavations, designed to collect and hold surface runoff. They hold water only after runoff events. The greater depth of the reservoirs compared to the natural playa surface allows the reservoirs to support wildlife for longer periods than ephemeral ponds and playa lakes.

Two additional reservoir permit locations showed no sign of man-made features. They are natural reservoirs resulting from the dune development around the perimeter of Antelope Lake playa in Cactus Flat.

Wells

Groundwater is an important resource on the NTTR. A total of 59 wells and mine shafts with potential for providing water were located during the water resources reconnaissance effort (Appendix C, Table C-3). There are 22 known production wells on the NTTR. Five of these are little used and may not have working pumps. Three production wells are owned and operated by Sandia National Laboratory, and support NNSA activities in Cactus Flat. Water samples were collected from the 17 operating production wells, and from monitoring well PM-3 in Oasis Valley. Results of the chemical analyses are in Appendix C, Table C-4.

3.5.3.2 **Water Use**

Historic groundwater use information for 11 of the Air Force wells was reported in the EIS for renewal of the NTTR withdrawal (USAF, 1999). These wells, listed in Table 3-5, are located at TTR (5 wells), TPECR-O&M Compound (1 well), Tolicha Peak (1 well), Indian Springs (2 wells), and at Point Bravo and Silver Flag Alpha (1 well each). For the years 1995, 1996, and 1997, the collective groundwater production from these wells totaled approximately 231, 229, and 265 acre-feet, respectively.

All of the production wells in the planning area are located in the valleys on alluvial landforms. They generally draw water from several hundred feet or more below land surface. Topographically, springs are located above the wells and receive water from infiltration higher on the mountain block. Well production should not affect spring discharge.

Table 3-5. Production wells on the NTTR.

Hydrographic Basin	Well
Stone Cabin Valley	EH-7, 1A, 3A, 3B, BLM
Cactus Flat	EH-1, EH-2, Sandia 6, Sandia 7, Roller Coaster
Gold Flat	GO-2, GO-2A, O&M, S4
Tolicha Peak	TPECR
Emigrant Valley	WT-3, -4,
Indian Springs	62-1, 106-2
Three Lakes Valley	Pt Bravo, Pt Bravo backup
Las Vegas	Silver Flag Alpha

3.5.3.3 **Water Rights and Permits for Use**

Water resources in Nevada are managed under a prior appropriations doctrine. This legal doctrine holds that the oldest permitted right registered with the Nevada State Engineer's Office has priority use. Junior permits in a given water basin generally may not adversely impact the senior rights. Also, all water permitted by the State Engineer must be put to beneficial use. If use is not

continuous for a specified period of time, the permit holder risks losing their right to use the water, under a declaration of abandonment.

The Legislative EIS (USAF, 1999) lists 113 surface water sources, including 84 permits for springs and seeps and 19 for reservoirs. No permits are indicated for the nine wildlife guzzlers (precipitation collectors) and one tinaja (or poh) (natural rock formation that collects and holds surface runoff). Total permitted use from these water sources is approximately 946 acre-ft per year. Federal agencies hold permits for approximately 797 acre-ft per year (84 percent). The remaining permits are privately held. None of the surface water sources provides direct support for military mission. Also, water from many of the sources is not applied to the beneficial use approved under the permit.

Sixty-two underground water sources (e.g., production wells, monitoring wells, flooded mine shafts, and one spring) are identified in the LEIS (Table 3.6-5, USAF, 1999). Of these, 26 have assigned or pending permits. The Air Force has permits on nine wells for municipal use, with a total annual limit of approximately 1,153 acre-ft per year. The Air Force has seven pending permits on seven wells for industrial or municipal use, with an annual withdrawal limit of just under 465 acre-ft per year. Twelve wells are used routinely to supply water for Air Force activities in the planning area. Two others are operated as needed to support industrial (principally construction) activities. The permitted wells are located in Cactus Flat, Gold Flat, Indian Springs Valley, Three Lakes Valley, and Las Vegas Valley. In addition to the permitted production wells, the USAF operates 2 production wells in Emigrant Valley, and Sandia operates 3 wells in Cactus Flat.

Ten permits are held solely or jointly by the USAF (7), the BLM (1), and ranchers (3) for stock watering (Table 3.6-5, USAF, 1999). Permits for groundwater use for stock watering have a total annual limit of about 95 acre-ft per year. These water sources are located in Stonewall Flat, Gold Flat, Oasis Valley, Emigrant Valley, and Penoyer Valley. Field reconnaissance determined that four of the permits held for stock watering, Desert Well, Gold Crater, Sulphide (mine), and Naquinta Valley, are on sources that have gone dry or no longer have production capability. Georges Water may more properly be considered as a spring source. The remaining locations were not accessed during reconnaissance.

The remaining 36 sources listed in the LEIS (USAF, 1999) consist of unused production wells, monitoring wells, dry wells, destroyed wells, and flooded mine shafts.

3.6 **BIOLOGICAL RESOURCES**

3.6.1 WILDLIFE

The planning area has a diverse variety of habitat that supports many wildlife species. All plant communities and topographic features provide food and/or shelter for indigenous mammals, birds, reptiles, amphibians, and invertebrates. Habitat quality varies widely between locations. Some species and/or individual organisms probably are restricted to specific biotic communities, but most have a regional presence (i.e., occur on and off the planning area). Wildlife species discussed below include those directly observed during field surveys, or are species known to occur in adjacent areas (O'Farrell and Emery, 1976; USFWS, 1974b) with habitat types similar to those in the planning area.

Specific locations that provide important or critical wildlife habitat are the springs in the Groom Range, Belted Range, Cactus Range, Stonewall Mountain, and Pahute Mesa areas. Also, the widely-scattered earthen holding ponds historically used to water livestock often hold water for long periods. The playa lakes often have seasonal (primarily winter or early spring) surface water during wet years, but may remain dry for years. The playas and ephemeral ponds support at least two species of aquatic crustaceans (fairy shrimp and tadpole shrimp).

3.6.1.1 **Game Species**

Game species are wildlife subject to hunting and trapping. Nine terrestrial game species reside in the planning area at least part of the year. These include: Gambel's quail, chukar, mourning dove, desert cottontail (*Sylvilagus audubonii*), Nuttall's cottontail (*Sylvilagus. nuttallii*), mountain lion (*Felis concolor*), mule deer, pronghorn antelope, and desert bighorn sheep. Of these, only the mourning dove is migratory. Migratory waterfowl include a variety of ducks and geese, of which the mallard (*Anas platyrhynchos*) is the most common species. Most waterfowl migrate through the planning area, however, some individuals may become residents.

Sage grouse have been observed once in the planning area. The NDOW counted three birds along the northern boundary at Silverbow during an antelope survey in July 2000. Subsequent visits to the area in March and April 2001 by the BLM and NDOW did not find any grouse. As shown in Figure 3-4, some potential seasonal habitat was identified in northeast Cactus flat, between Silverbow and the Cedar Pass Road. The quality of the habitat appears low. Understory grasses and forbs are not abundant in much of the sagebrush community.

3.6.1.2 **Prominent Large Mammals (except wild horses and burros)**

Pronghorn

Pronghorn antelope are year-long residents in part or all of Cactus Flat, Kawich Valley, Sand Springs Valley, and Emigrant Valley (Figure 3-5). There are no records of antelope using much of Stonewall Flat, but they have been observed near Mud Lake, Tolicha Peak, along Highway 93 north of Beatty, and the south end of the Cactus Range. There is historical year-round range in the Goldfield Hills as shown in Figure 3-5. This suggests they may use part, or all, of Stonewall Flat sometime during the year. Pronghorn primarily utilize the sagebrush, saltbush, and hopsage-desert-thorn vegetation associations. Pronghorn are not normally found in the pinyon-juniper zone of the Groom, Belted, and Kawich ranges. No populations have been found in the southern planning area.

Pronghorn movement patterns in the planning area are poorly documented. Their use of specific locations in the valleys probably varies substantially between years, due to water availability, snow depth, and forage quality and availability. The NDOW has documented movement from the Reveille Valley area into the planning area near Kawich Valley (personal communication, Craig Stevenson, NDOW).

Pronghorn generally prefer open exposures, with short vegetation (< 18 in tall) and long lines of sight. Pronghorn populations are highest where water sources are less than 1-2 miles apart, but they will travel over 5 miles for water. Pronghorn diets vary seasonally, but there is a strong preference for palatable forbs in the spring and summer (if available). Shrubs are selected in the summer and winter. Detailed information about diets can be found in Yoakum (1990), Sundstrom et al. (1973), Smith and Malechek (1974), Johnson (1979), Smith and Beale (1980), and Stephenson et al. (1985). Predation by bobcats, coyotes and mountain lions can limit population size (Beale and Smith, 1973).

Mule Deer

Mule deer are year-long residents on mountain ranges throughout the planning area (Figure 3-6); however, no recent census has occurred. Deer may move between mountain ranges, but a regular migration (winter and spring) pattern has not been documented (USAF, 1985). Environmental conditions that typically trigger migratory behavior (e.g., prolonged snowfall, deep snow cover over large areas, and long intense cold) are much less frequent in south-central Nevada than in other parts of the Great Basin. Deer herds whose home range includes mountain slopes at low to moderate elevations (5,000 to 7,000 ft) do not appear to have evolved regular (annual) migration cycles. The mountain ranges on the NTTR have a rapid change in elevation across a short horizontal distance. This permits deer to move rapidly to lower elevations when unusually large snowfall occurs. Also, snow on south-facing slopes melts quickly, providing access to forage, and relatively warm microenvironments. Mule deer probably are seasonal or occasional inhabitants in the Jumbled

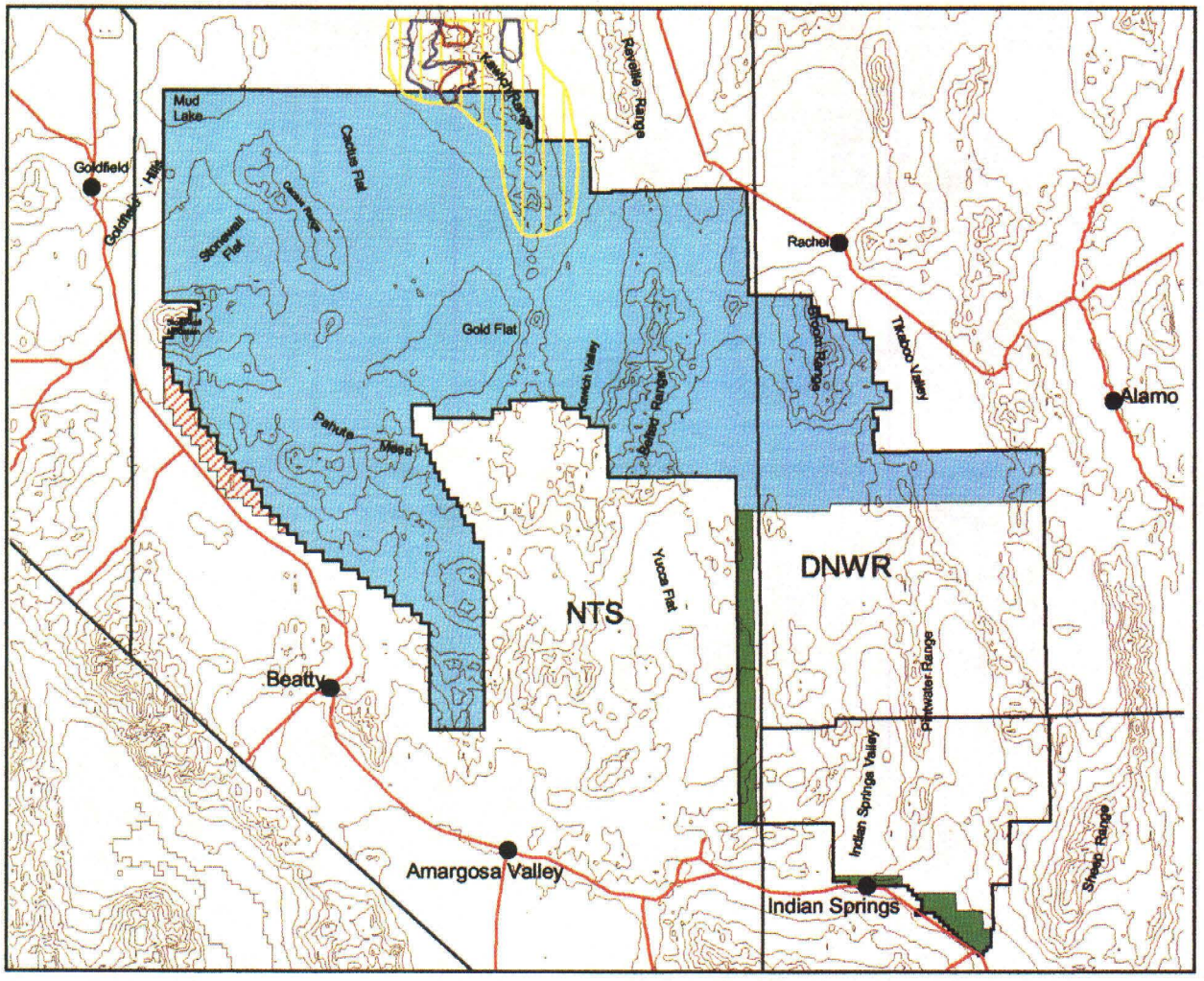
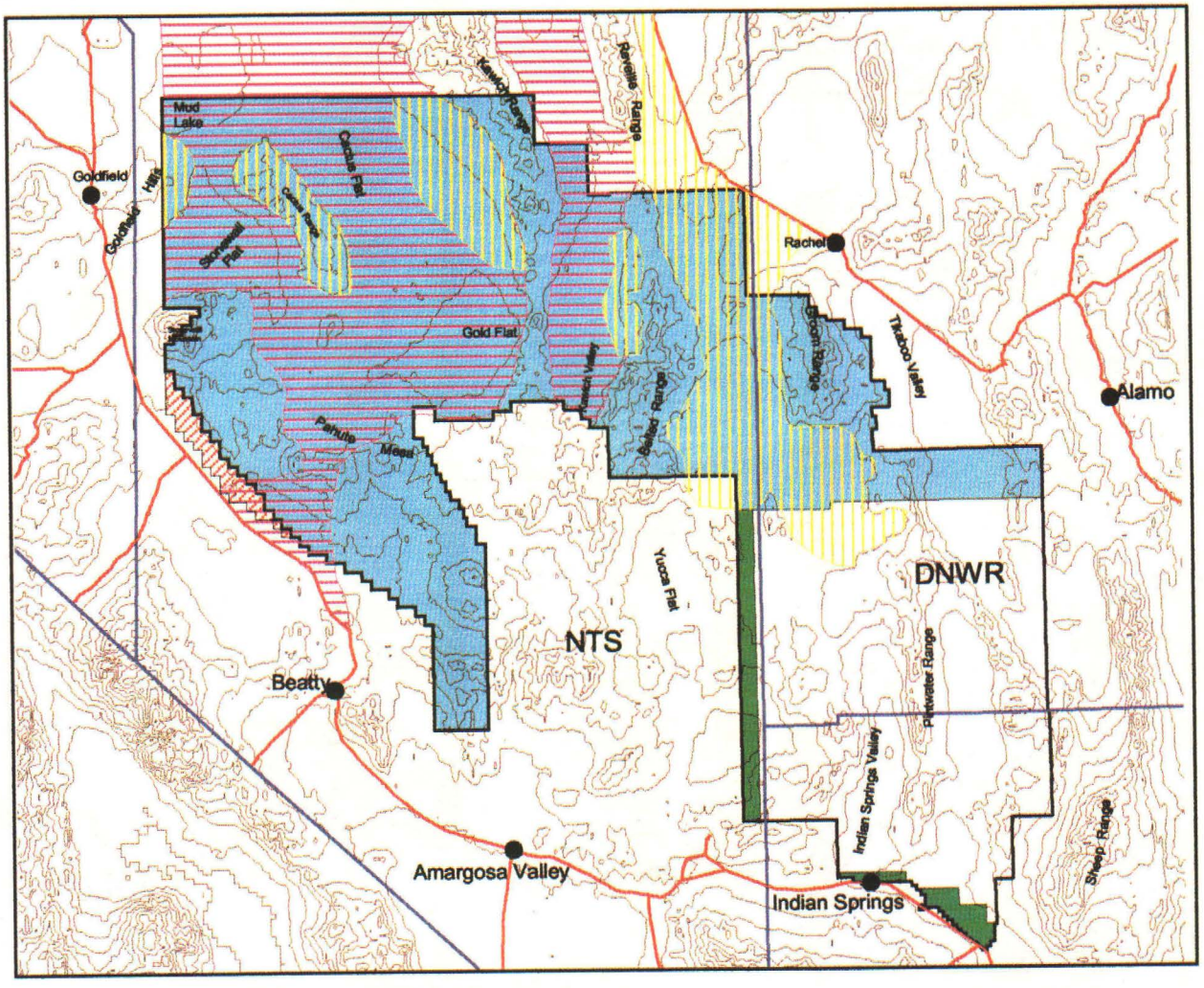


Figure 3-4. Potential Sage Grouse habitat as mapped in Spring, 2001



30 0 30 60 Kilometers

20 0 20 40 Miles

Legend

- Communities
- Non-renewal Area

Antelope Use Areas

- Winter
- Year Round
- Major Roads and Highways
- County Boundaries
- 200 Meter Contours
- Nevada Test and Training Range
- Northern Planning Area
- Southern Planning Area

N

NTTR boundary data obtained from the NTTR Range Management Office.

Figure 3-5. Antelope use areas.

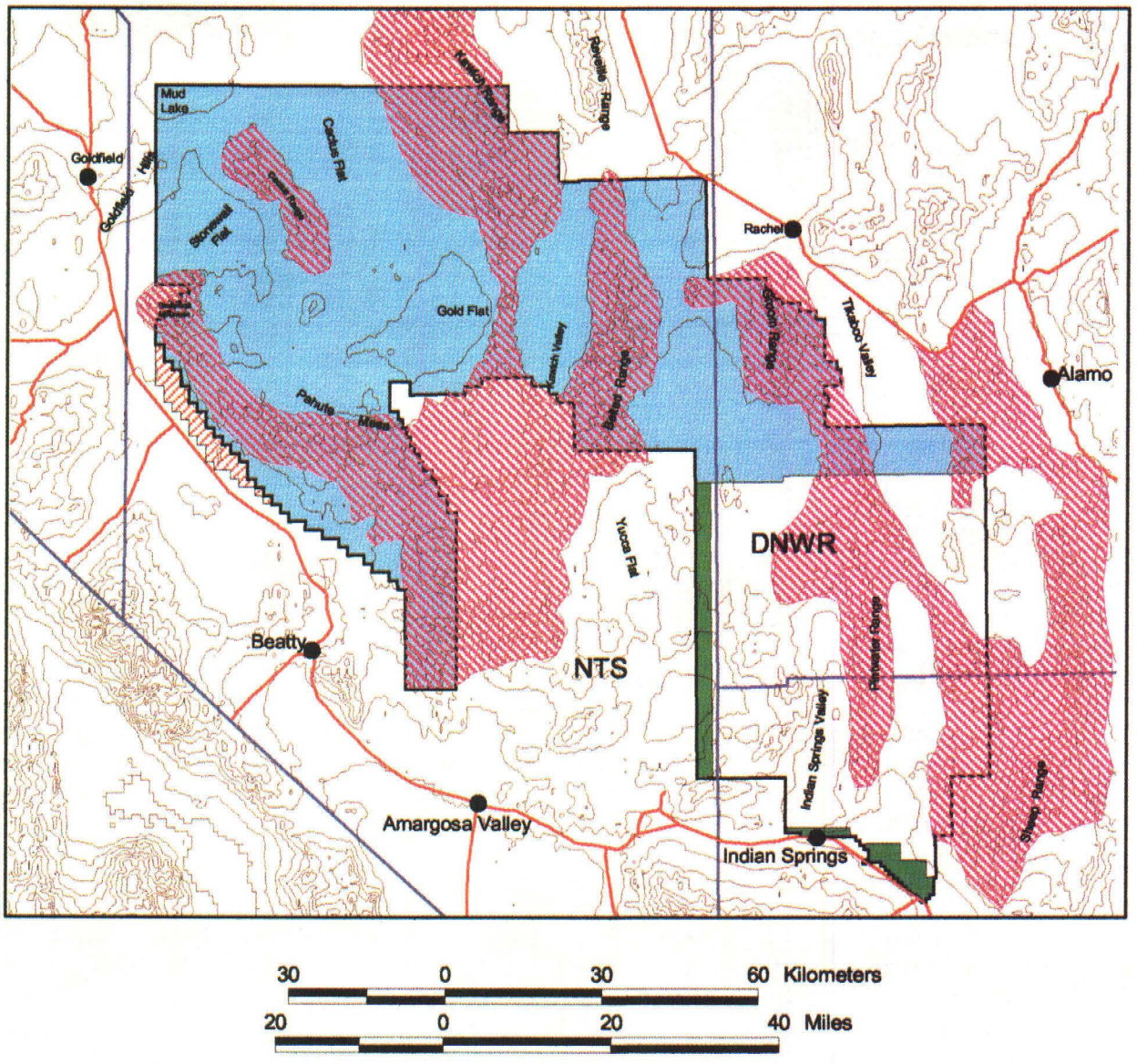


Figure 3-6. Mule deer use areas.

Hills, northern Pintwater Range, Buried Hills, and Halfpint Range. Poor water distribution during the summer months, and limited thermal cover probably limit deer use to the winter and spring.

Poor water distribution in valley locations, and a general absence of hiding cover results in little use of these areas. Unlike antelope, mule deer have a strong preference for sites with tall hiding cover. Tueller and Monroe (1975) reviewed management guidelines for mule deer habitat in Nevada, and Tueller (1979) reviewed food habits and nutrition. Tueller and Monroe's summary of habitat use found deer virtually absent from closed canopy woodlands. Deer also strongly avoided blackbrush sites. Open woodlands with an understory of big sagebrush, black sagebrush, bitterbrush and cliffrose were generally well used by mule deer. Low-elevation sagebrush-grass sites received some use, but the highest relative use was in the mountain brush zone. The mountain brush zone generally resides above the pinyon-juniper woodlands, in the 12 to16 in precipitation zone. Plant communities with substantial amounts of antelope bitterbrush, snowberry, Anderson peach, curlleaf mountain mahogany, serviceberry, mountain sagebrush, aspen, Gambel oak, and cliffrose will support higher levels of deer use. Many of these shrubs provide a significant part of the diet in both the summer and winter months (Tueller, 1979). Additional information about habitat requirements for mule deer can be found in Severson and Medina (1983) and Dasman (1981).

Bighorn Sheep

Bighorn sheep are found on the NTTR in two general locations. On the South Range they are common on the Spotted Range, Pintwater Range, and the Desert Range (Figure 3-7). Most of these areas are outside the planning area. The north end of both the Pintwater Range and Desert Range merge at the southeast corner of the northern planning area. Some sheep periodically use habitat in this area (Jumbled Hills); however, the frequency and duration of use is unknown.

On the North Range, 32 bighorn sheep were released onto Stonewall Mountain between 1975 and 1983. Between 1977 and 1999, census numbers have ranged from a low of 6 (1978) to a high of 175 (1995). The latest census (1999) counted 71 sheep with a composition of 15 rams, 34 ewes and 22 lambs for a normalized ratio of 44 rams:100 ewes: 65 lambs.

Information provided by NDOW indicates the bighorn sheep population has expanded from Stonewall Mountain to inhabit areas in the Cactus Range, Mount Helen, the rim country (Civet Cat and Packrat Canyon areas) between Stonewall Mountain and the Cactus Range, the western rim of Pahute Mesa between Stonewall Mountain and Tolicha Peak, and the area bounded by Tolicha Peak, Black Mountain, and Thirsty Canyon (Figure 3-7). The area inhabited is a mix of year-round range and winter range. Aerial survey reports indicate the sheep use a variety of habitat types, including sagebrush, black sagebrush, low desert shrubs, open pinyon-juniper woodlands, and blackbrush (winter survey only).

Bighorn sheep ecology has been reviewed in several books (Valdez and Krausman, 1999; Monson and Sumner, 1980), and biological bulletins or monographs (McQuivey, 1978, Wilson et al., 1980:Van Dyke et al., 1983; Smith et al., 1988; McCarty and Bailey, 1994). In general, these reviews and studies indicate that bighorn sheep have strict requirements for feeding areas, escape cover, breeding areas, resting (loafing) sites, and lambing areas. Water probably is the most limiting resource. The relative use of specific springs appears to be related to the amount of forage available

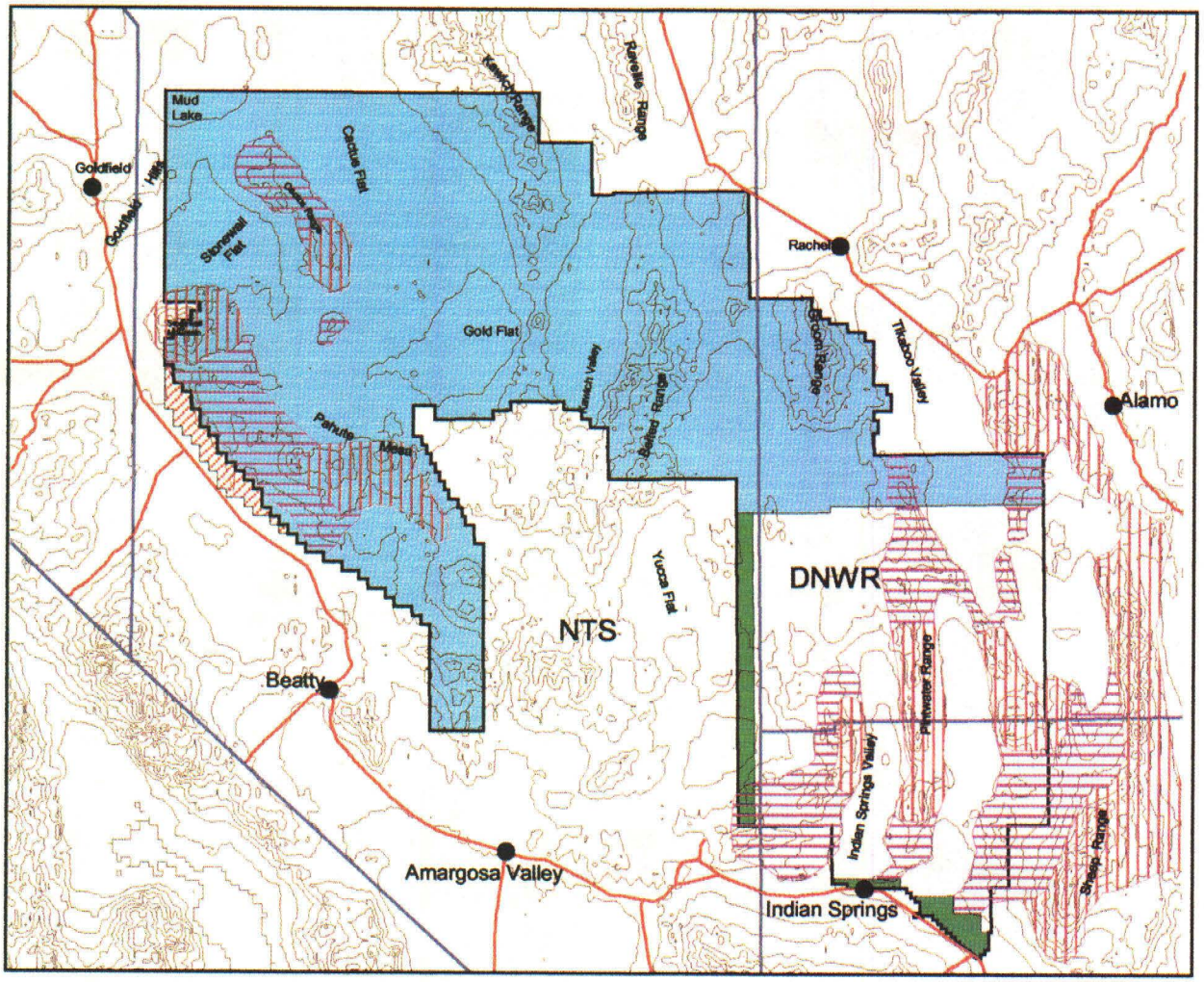


Figure 3-7. Bighorn sheep use areas.

(Leslie, 1978), the presence of feral burros (and presumably horses: Dunn, 1993), and the availability of escape cover (Dunn, 1993; Smith and Flinders, 1992). Sheep use increased at some springs after burros were removed, but only if escape cover was available. Aircraft noise has been shown to cause limited physiological responses (Krausman et al., 1996; Weisenberger et al., 1996), but these responses have not been linked to population level changes. Both studies indicate that sheep quickley become habituated to moderate levels of repeated overflights. Also, predation from mountain lions appears to have the potential for limiting population size (Wehausen, 1996). The effect of predation appears to be inversely related to the size of the area inhabited (reviewed in Wilson et al., 1980).

Desert bighorn sheep historically occupied the Groom Mountain Range, but are not currently present (USAF, 1985). In 1994, the NDOW ranked the Groom Mountain Range eleventh in Nevada and sixth in Lincoln County as a possible site for the reintroduction of bighorn sheep. No sheep were reintroduced before the withdrawal of the Groom Range. The Groom Range is closed to hunting and other public access and, therefore, it is very unlikely the NDOW will introduce them.

Mountain Lion

Mountain lions probably inhabit most, if not all, of the mountainous terrain in the planning area. They may traverse the valley bottoms in search of food, or more likely while moving among hunting locations. The valleys, however, are not suitable for permanent residence. Water, food, and hiding cover are too limited.

Coyote

The coyote is ubiquitous across much of the planning area. Local populations often appear much larger at industrial complexes, and areas with regular human activity. Dumps and other food sources are attractants that can result in larger populations.

Coyotes can become habituated to humans, and can be considered a pest species when relatively large numbers depend on human garbage and refuse for their existence. Personnel are periodically bitten, when they unwisely attempt to feed or befriend the canines. Airfield personnel consider coyotes a safety hazard when they reside on runways used by aircraft.

At locations distant from human activity, coyotes are important carnivores that help regulate populations of small mammals and rabbits. They have very flexible reproduction rates that respond quickly to environmental conditions. Birth rates (at the population level) can increase in response to control efforts.

3.6.1.3 **Fur Bearers**

State protected and managed furbearers known or expected to inhabit the planning area include kit fox (*Vulpes macrotis*), red fox (*Vulpes fulva*), gray fox (*Urocyon cinereoargenteus*), and bobcat (*Lynx rufus*). Kit foxes were frequently sighted during the 1985 survey of the Groom Range (USAF, 1985). Kit foxes probably are present throughout both planning areas in the saltbush, hopsage-desert-thorn, and blackbrush communities; however, their secretive nocturnal nature results in few observations. The red and gray fox have low abundance throughout the region and generally inhabit higher elevation areas, with a mixture of open forest, shrubland, and/or rock outcrops. Bobcat sign has been observed throughout the area, but their nocturnal and reclusive nature results in few sightings. For the aforementioned species, a low number of sighting is not a good indicator of their local abundance or habitat use.

3.6.1.4 **Small Mammals**

Small mammals (squirrels, rats, mice, etc.) are a ubiquitous component of the fauna across the entire planning area. No quantitative studies have been conducted on the range to identify the species present, their relative abundance, annual variation in population size, variation in population size by plant community, or response to anthropogenic activities. Population monitoring studies at Yucca Mountain found 11 species, and showed community size (i.e., all species collectively) can

vary widely by year and plant community type (EG&G, 1993). Populations peaked during years with above average precipitation, and often were 5 to 20 times larger than during years with severe drought.

Small mammals facilitate many important ecological functions, and can serve as ecological engineers (reviewed by Fagerstone and Ramey, 1996). Among their functions are caching seed which facilitates seed germination and seedling establishment, mixing soils, enhancing nutrient cycling, and providing food sources for a variety of carnivores. Their ability to consume large amounts of seed can influence plant species composition (Brown and Heske, 1990; McAdoo et al., 1983), potentially affecting the type and relative amount of forage available for a suite of other fauna.

3.6.1.5 **Migratory Species**

Migratory Waterfowl

Many species of ducks, geese, and other water birds are both common and uncommon seasonal migrants throughout the planning area. Most waterbird would be expected to be elsewhere in the region, particularly in the Pahranagat Valley. Potential NTTR winter residents include 5 species of loons and grebes, 4 species of herons and bitterns, 19 species of waterfowl, 5 species of shorebirds, and 2 species of gulls. They are attracted to several year-round small ponds, as well as ephemeral stock ponds, and the playas during wet years. The ephemeral and unpredictable presence of most small ponds and larger lakes may render them non-critical, but opportunistic resources for migrating avifauna. The number of birds present at any given time is relatively small (tens to hundreds), but their use of the playas remains constant while water is available. Because migrating waterfowl (and resident ungulates) can obtain water and/or feed from ephemeral ponds and lakes, the potential introduction of contaminants is an important management issue. Potential contaminants are discussed in Section 3.9, Waste and Hazardous Materials Management.

Neotropical Migrants

Numerous neotropical migratory bird species occur in the planning area. The horned lark is the most common species. Also abundant are the mourning dove, sage thrasher (*Oreoscoptes montanus*) and sage sparrow (*Amnphispiza belli*). In the Dames and Moore, 1996 NTTR bird study (USAF, 1997), 63 of the 133 species of neotropical migrants listed for Nevada in Alcorn (1988) were observed. The observed species inclided two (burrowing owl and gray flycatcher) that are ranked high in Nevada for conservation priority.

Horned larks are an important management issue because they congregate near airfields, increasing the potential for collisions with aircraft. Individual birds are small, but horned larks form large flocks, and several flocks may simultaneously occupy a runway. If a large number of birds are ingested into an engine, serious damage is possible, and could result in a crash with serious injury or substantial loss of life. Horned larks have a year-long resident population that is augmented in the early summer by recent births, and in the spring and fall by seasonal migration.

Horned larks typically inhabit areas with low and widely scattered shrubs and large amounts of bare ground. Horned larks feed on seeds from many species during the winter, but switch to insects in the late spring and summer. Larks have no physiological adaptation to reduce evaporative water loss; therefore, increased demand must be met by either surface water supplies or succulent food.

Facilities in the planning area coincide with the preferred habitat of horned larks, and are located on an established migration route. The migratory nature of many larks makes population control more difficult. Birds that are directly or indirectly eliminated are quickly replaced by new arrivals. Direct purposeful take (killing) is a violation of the Migratory Bird Treaty Act; however, permits can be issued for removal of birds posing safety hazards to pilots and planes. The best approach is to decouple (separate) the birds from flight operations, to the extent possible.

3.6.1.6 **Raptors**

Raptors (birds of prey) protected by the Migratory Bird Treaty Act and/or the Eagle Protection Act are important predators of small mammals, reptiles and other birds. Many also consume carrion, much of which results from road kill of small mammals and lagomorphs. They often provide effective and efficient population control of potential pest species. Data on the geographic range of many North American raptors (Herron et al., 1985), and field sightings throughout the region (Hayward et. al., 1963; USFWS, 1974b) suggest that as many as 18 species of raptors use the planning area. Common nest sites include utility poles, cliffs, rock outcrops, tall structures, and large trees. Based on observations in the 1996 surveys, (USAF, 1997), raptors that inhabit the NTTR for nesting purposes include red-tailed hawks, golden eagles, prairie falcons, American kestrels, common barn-owls, and great horned owls.

3.6.1.7 **Bats**

Bats are important fauna because they provide cheap and chemical free population control for many insects and invertebrates. Some bats also pollinate desired flora. In southern Nevada, bats form a diverse vertebrate assemblage, with over 20 species identified. Sensitive bat species are discussed in Section 3.6.4.2. Non-sensitive species that occur in southern Nevada include: California myotis (*Myotis californicus*); little brown myotis (*Myotis lucifugus*); small footed myotis (*Myotis subulatus*); silver-haired bat (*Lasionycteris noctivagans*); western pipistrel (*Pipistrellus hesperus*); red bat (*Lasiurus borealis*); big-brown bat (*Eptesicus fuscus*); Hoary bat (*Lasiurus cinereus*); Mexican big-eared bat (*Plecotus phyllotis*); and pallid bat (*Antrozous pallidus*).

Environmental factors that influence the spatial and temporal distribution and abundance include: climate; roost availability and distribution; food availability; and interactions with other vertebrates. Species-specific data are in Appendix D. Climate and roost availability are probably the most critical factors affecting bat distribution in Nevada.

3.6.1.8 **Reptiles**

Reptiles are common across the entire planning area. No inventories or population monitoring studies are known to have occurred in the planning area; thus, information about species composition must be extrapolated from other areas with similar habitat. The most comprehensive regional studies have occurred on the NTS and Yucca Mountain. Sampling in Mojave Desert Scrub community types identified 10 lizard species and 13 snake species (EG&G/EM, 1992; 1993). The majority of lizards collected were wither side-blotched (*Uta stansburiana*) or western whiptails (*Cnemidophorus tigris*). The lizard population was substantially larger than for snakes. Species on the North Range are similar to those on the South Range, but the relative abundance among species is unknown. In the planning area, changes in population size and structure in response to human activities and/or environmental variation are unknown.

3.6.2 VEGETATION

Vegetation across the planning area has not been adequately mapped or classified using either standard BLM techniques (i.e., range/ecological site), or other classification schemes. Ecological status was assessed in the NWHR (SAIC, 1999), but those data have limited use. Range sites were identified, but not mapped. Also, data were not obtained for all range sites located in each map unit and mountainous areas were not inventoried. Many of the management objectives for other resources discussed in this management plan require that plant communities be mapped/classified.

3.6.2.1 **Plant Communities**

Many broad vegetation associations typical of the southern Great Basin reside in the Northern planning area. These include the Intermountain Salt Desert Shrubland (West, 1983), blackbrush,(*Coleogyne ramosissima*) the Great Basin-Colorado Plateau sagebrush (*Artemisia* spp) semi-desert (West, 1983), pinyon-juniper woodlands, mountain brush zone, subalpine forest, wet meadow/riparian, and anthropogenically disturbed sites (e.g., construction, testing). The southern

planning area is typified by vegetation from the Mojave Desert, or transition from Mojave to Great Basin Desert.

There have been no detailed vegetation maps constructed for the planning area. This precludes providing data about the relative proportion of each vegetation association, let alone specific plant community types. Descriptions below are limited to the general ecology of each association, and are from the broadly available literature base. Each complex can be further partitioned into several or more range sites, habitat types, or community types (Hironaka, 1986).

Great Basin Desert

The Intermountain Salt Desert shrubland can be divided into a number of different plant complexes based on the dominant (ecological or abundance) shrub. Common complexes on the North Range have one or more of the following shrubs as the most abundant species: shadscale (*Atriplex confertifolia*), winterfat (*K. lanata*), four-wing saltbush (*Atriplex canescens*), greasewood (*Sarcobatus vermiculatus*), spiny hop-sage (*Grayia spinosa*), and bud sagebrush (*Artemisia spinescens*). Some, but not all, community types have substantial primary production from perennial grasses and forbs. Common grasses include Indian ricegrass (*Achnatherum hymenoides*), desert needlegrass (*Achnatherum speciosum*) and galleta grass (*Pleuraphis jamesii*). The Salt Desert shrub type is restricted largely to the valley bottoms and lower alluvial landforms. Many of the industrial complexes, fixed targets, and electronic warfare sites are located in this plant association. Common weeds on disturbed sites are Halogeton (*Halogeton glomeratus*) and Russian thistle (*Salsola tragus*).

The sagebrush semi-desert complex has sub-associations with the following indicator species: black sagebrush (*Artemisia nova*), Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), mountain big sagebrush (*Artemisia tridentata* ssp *vaseyana*), and low sagebrush (*Artemisia arbuscula*). These shrubs often form a continuum from the drier sites on alluvial plains and piedmont fans, upslope to the mesic tops of the highest peaks. The specific species of sagebrush at any given location is largely the result of interactions among temperature and precipitation, and how they are modified by elevation, aspect, topography (macro and micro), wind, snowdrift, and the soil's water-holding capacity. Another primary influence is soil salinity. None of the sagebrush species tolerates saline soil(Caldwell, 1979; Gates et al.,1956). Distinct sagebrush communities are common but two or more species can intergrade, particularly along broad ecotones, or along washes or other corridors that convey water from wetter to drier landscapes.

Black sagebrush and Wyoming sagebrush generally occur on the upper fan piedmonts, alluvial fans, and the lower foothills and/or mountain sideslopes. Black sage assumes dominance on the more xeric sites with lower water-holding capacities due to shallow depth, high rock content, or caliche at shallow depths. Basin big sagebrush occurs in ephemeral channels that bisect the black sage and Wyoming sage sites, where run-on moisture is common and soils are deeper. Low sage and mountain sage complexes are found in the mountain ranges at elevations above 6,500 to 7,000 ft. Low sage typically inhabits sites with shallow soil to bedrock or a claypan. Mountain sage inhabits mountain sideslopes with deeper soil (i.e., higher water-holding capacities).

A variety of bunchgrasses and perennial forbs commonly occur with the sagebrush species. For grasses, cool season bunchgrasses typify the upper elevations. Lower elevations have a mix of cool and warm season bunchgrasses, but cool season species predominate. The warm season rhizomatous species, Galleta grass, is common at lower elevations, particularly on sites heavily grazed by wild horses. Its rhizomatous growth enhances its resistance to grazing (Dahl and Hyder, 1977).

Absolute ground cover on sagebrush sites ranges from about 10 to 40 percent (West, 1983), with the relative cover from sagebrush often above 70 percent. Above ground, primary production varies widely by sagebrush complex and individual ecological site within a complex (USDA, 1987).

Most sagebrush species are highly competitive (Robertson, 1972; Young et al., 1972) and possibly alleopathic (Schlatterer and Tisdale, 1969). Their ecological dominance, combined with substantial community change when removed (Vale, 1974), demonstrates their function as a keystone species (West, 1983).

The invasive annual, cheatgrass (*Bromus tectorum*), is common in many areas, particularly those subject to either natural (e.g., rodents) or anthropogenic disturbance to the soil. Halogeton and Russian thistle are less common, and usually are abundant only on intensively or frequently disturbed sites.

Pinyon-juniper (PJ) woodlands are common on many mountain ranges in the northern planning area (Figure 3-8). The PJ woodlands are significant for several reasons. First, they cover tens-of-thousands of acres, and are expanding into sagebrush rangelands. Second, the vegetative biomass on each acre of woodland is often 10 to 20 times larger than on adjacent shrub-dominated rangelands (Tiedemann, 1987). Third, the long-term increase in tree density, tree canopy cover, biomass, duff and litter eventually facilitates an increase in catastrophic crown fires, which eliminates all vegetation. Fourth, as the external (i.e., spatial area) and internal (increased density) expansion of PJ continues, understory biomass from desired shrubs, grasses, and forbs declines (Arnold et al., 1964, Blackburn and Tueller, 1970). Fifth, following fire, low-elevation woodlands are often re-occupied by cheatgrass, because seed from desired perennial species are absent. Rapid dominance by cheatgrass prevents secondary succession towards either shrub-grass rangelands or PJ woodlands, and shortens fire return intervals (Billings, 1994). Current evidence indicates that woodland expansion is from interactions among climate change, geomorphology, soil water holding capacity, improper grazing by introduced ungulates that reduced fine fuels, and a decline in fire frequency.

The white fir complex is limited to the higher mountains in the northern planning area. Known populations occur in the Groom Range on Bald Mountain, and in the Belted Range on Wheelbarrow Peak. The white fir stands typically are located above 8,000 ft, and usually on northern aspects or near ridgelines. Additional stands of white fir may occur in the Kawich Range: most likely in parts of the Kawich Range located off the planning area. The Kawich Range's highest peaks are found north of the NTTR. There are no known military activities in this association.

Limber pine are restricted to the Groom Range, on the north and east faces of Bald Mountain, and the Kawich Range (Beatley, 1976). These stands are relicts from the Pleistocene (ice-age) forests that covered many of the higher valley bottoms, foothills, and lower mountain slopes (Van Devender and Spaulding, 1979). Following a warming period throughout much of the Holocene (last 10,000-12,000 years), isolated stands of limber pine have taken refuge on the higher peaks of the southern and central Great Basin. There are no known military activities in this association.

The mountain brush zone generally is located above or in the upper part of the pinyon-juniper woodland, where the annual precipitation averages 12 to 16 inches. Characteristic species include Mountain mahogany (*Cercocarpus ledifolius*), Oak (*Quercus spp*), bitterbrush (*Purshia tridentata*), snowberry (*Symphoricarpos rotundifolius*), serviceberry (*Amelanchier utahensis*), mountain sagebrush, cliffrose (*Purshia mexicana*), Douglas rabbitbrush (*Chrysothamnus viscidiflorus*), chokecherry (*Prunus virginiana*), and Anderson peach (*Prunus Andersonii*). Perennial grasses and forbs are common in the understory. The mountain brush complex usually is not continuous across a landscape, but forms discrete patches in a matrix of mountain sagebrush or pinyon-juniper woodland. The tall, thick brush provides hiding and thermal cover for wildlife, as well as forage. The Air Force conducts few if any activities directly in the mountain brush complex. Indirect effects (e.g., accidental wildfire) are possible, and could adversely affect habitat important for mule deer, mountain lion, and a variety of avifauna, for several years after a fire. Mountain brush sites usually recover quickly after a wildfire.

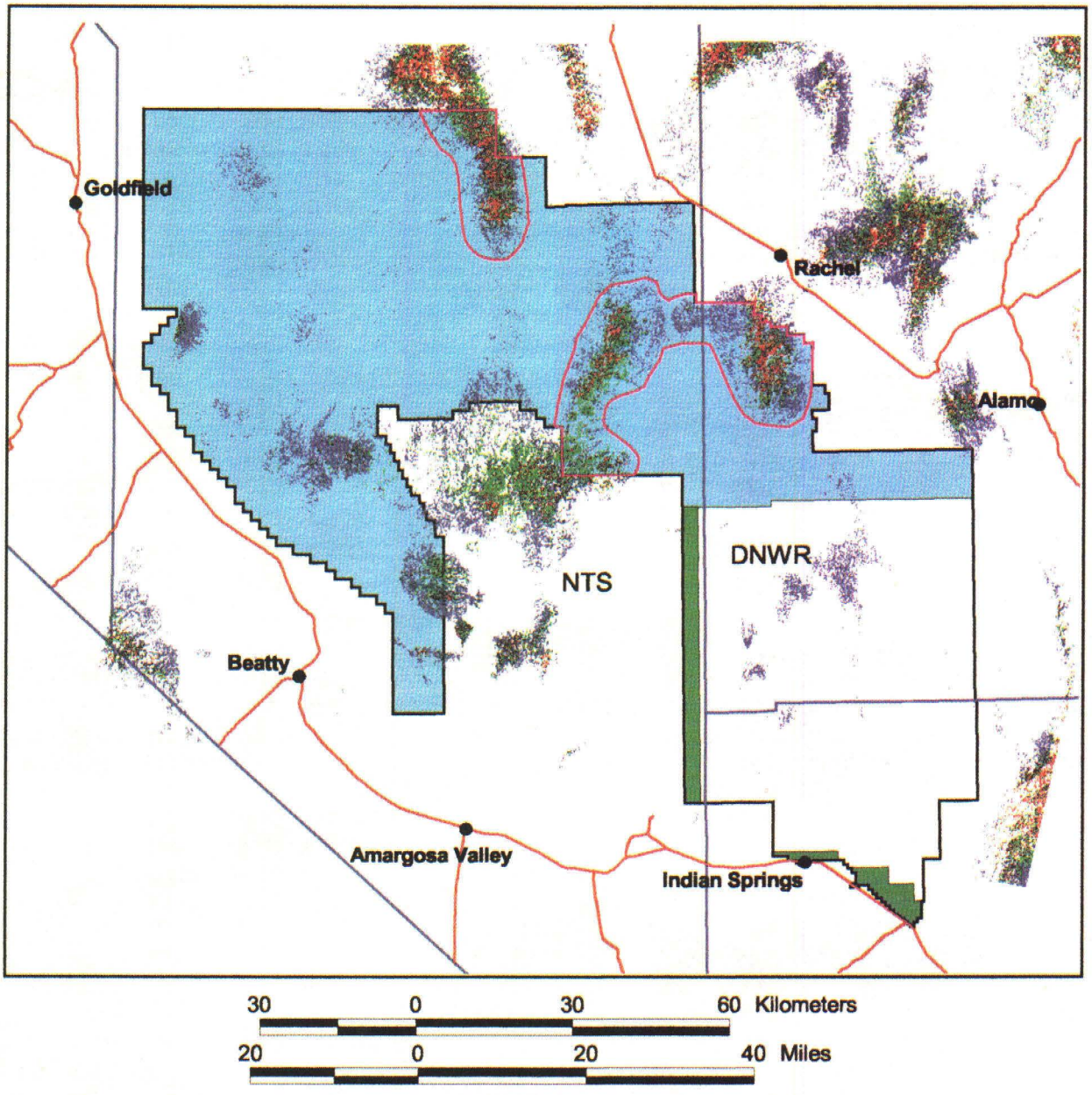


Figure 3-8. Pinyon juniper woodlands classified using Landsat Enhanced Thematic Mapper (ETM) satellite imagery.

Mojave Desert Community Types

Mojave Desert community types are restricted almost entirely to the southern planning area. Beatley (1976) describes four broad vegetation associations that are located on different physiographic features. On alluvial fans and piedmonts, with deep sandy soil, creosotebush (*Larrea tridentata*) and bursage (*Ambrosia dumosa*) form the creosote-bursage association. The elevation is usually less than 4,000 ft. Sites with less sand and more rock fragments have an increase in desert-thorn (*Lycium andersonii*) and spiny hopsage. Other common associates are wolfberry (*Lycium pallidum*), shadscale, Nevada Mormon tea (*Ephedra nevadensis*), range ratany (*Krameria parvifolia*), winterfat, Shockley goldenrod (*Acamptopappus shockleyi*), brickelbush (*Brickelia* spp.), Encelia (*Encelia virginiensis*), Cooper's goldenbush (*Ericameria cooperi*), and spiny menodora (*Menodora spinescens*). Common grasses include Indian ricegrass, desert needlegrass, and fluffgras (*Erionuron pulchellum*). Many annual forbs are common. They have very high biomass in wet years, but are nearly absent in dry years.

Ephemeral washes typically have species from the adjacent uplands, but also numerous species largely restricted to wash environments, or other areas frequently disturbed. These include: Black-stem rabbitbrush (*Chrysothamnus paniculatus*), Bladder sage (*Salizarria mexicana*), *cattle saltbush (Atriplex polycarpa)*, big saltbush (*Atriplex lentiformis*), cheesebush (*Hymenochlea salsola*), and brickellbush (*Brickellia incana)*.

On the mountain sideslopes, between about 4,000 ft and 6,000 ft elevation, shadscale is a common (unifying) species across all plant communities. Most of the species that occur on alluvial landforms also are found on the mountain sideslopes, but at lower densities. Common shrubs are snakeweed (*Guiterizzia sarathorae*), brickelbush, California buckwheat (*Eriogonum californica*), blackbrush and Interior goldenbush (*Ericameria linearfolia*). This association is most common in the southern planning area, and part of the northern planning area near Groom Lake and Yucca Mountain.

The fourth association common in the Mojave Desert occurs around seeps and springs. There are no springs in the southern planning area, therefore, this association is not discussed.

Transition Desert

The transition desert zone lines between the Mojave and Great Basin deserts, generally between 4,000 ft and 4,500 ft elevation. This association is common in much of Emigrant Valley, areas near Beatty, and the lowest parts of Stonewall Flat. The valley bottoms and associated alluvial fans are too hot and arid to support sagebrush (except widely scattered bud sagebrush), and too cold to support creosotebush and bursage. Desert-thorn and spiny hopsage form a distinct community on the valley bottoms and younger alluvial surfaces. Big sagebrush may occur, but is restricted to drainages and other areas that receive run-on moisture. Palatable shrubs, grasses, and forbs are common in this association, but dependable surface water often is absent.

A second common community type is blackbrush. Blackbrush communities often inhabit old landforms and soils located above the desert-thorn/spiny hopsage communities and below the sagebrush community types. Species diversity for perennials typically is very low. The appearance of a monoculture is common. Annual forbs can be common during wet years, but forage for most species is lacking. Blackbrush is not considered palatable for most species, though diet studies of bighorn sheep have shown they consume blackbrush every month, in low quantities.

3.6.2.3 **Noxious/Invasive Weeds**

The phrase "noxious weeds" is a legal term that identifies any plant designated by a federal, state, or county government to be injurious to public health, agriculture, recreation, wildlife, or any public or private property (Sheley et al., 1999). Table 3-6 lists noxious weeds in Nevada. Invasive species may or may not be legally defined as noxious. Both noxious and invasive species can have long-term consequences for ecological structure, composition, and function across large landscapes.

Table 3-6. Noxious weeds identified by the Nevada Department of Agriculture.

Common Name	Scientific Name
African rue	*Peganum harmala*
Austrian fieldcress	*Rorippa austriaca*
Austrian peaweed	*Sphaerophysa salsula*
Black henbane	*Hyoscyamus niger*
Camelthorn	*Alhagi camelorum*
Common crupina	*Crupina vulgaris*
Dyer' woad	*Isatis tinctoria*
Eurasian water-milfoil	*Myriophyllym spicatum*
Goats rue	*Dalega officinalis*
Klammath weed	*Hypericum perforatum*
Hemlock, Poison	*Conium maculatum*
Hemlock, Water	*Cicuta maculata*
Horse-nettle, Carolina	*Solanum carolinense*
Horse-nettle, White	*Solanum elaegnifolium*
Houndstongue	*Cynoglossum officinale*
Hyudrilla	*Hydrilla verticillata*
Knapweed, Diffuse	*Centaurea diffusa*
Knapweed, Russian	*Acroptilon repens*
Knapweed, Spotted	*Centaurea masculosa*
Knapweed, Squarerose	*Centaurea virgata Lam.*
Leafy spurge	*Euphorbia esula*
Mayweed chamomile	*Anthemis cotula*
Mediterranean sage	*Salvia aethiopis*
Medusahead	*Taeniatherum caput-medusae*
Tall whitetop	*Lepidium latifolium*
Puncture vine	*Tribulus terrestris*
Purple loosestrife	*Lythrum salicaria*
Rush skeletonweed	*Chondrilla juncea*
Saltcedar	*Tamarix ramossima*
Sorghum/Johnson Grass	*Sorghum halepense*
Sulfur cinquefoil	*Potentilla recta*
Thistle, Canada	*Cirsium arvense*
Thistle, Musk	*Carduus nutans*
Thistle, Scotch	*Onopordum acanthium*
Thistle, Sow	*Sonchus arvensis*
Thistle, Iberian star	*Centaurea iberica*
Thistle, Purple star	*Centaurea calcitrapa*
Thistle, Yellow star	*Centaurea calcitrapa*
Toadflax, Dalmation	*Linaria dalmatica*
Toadflax, Yellow	*Linaria vulgaris*
Whitetop or Hoary Cress	*Cardaria draba*

Most of the noxious and invasive species on western rangelands originated in Europe and Asia, and have been introduced without their natural biological controls. Rapid expansion and colonization are possible. Weeds typically colonize highly disturbed areas (e.g., river and stream banks, trailheads, roadsides, building sites, trails, faunal bedgrounds, and overgrazed areas).

Noxious Weeds

The only noxious weed known to occur on the NTTR is salt cedar (*Tamarix ramosissima*). It is a prolific root sprouter, and typically inhabits sites with shallow groundwater. Existing populations are not spatially extensive, because they require riparian/shallow groundwater conditions, which are few. Each riparian area, however, is threatened with complete type conversion to salt cedar. Control efforts are largely limited to removal of the existing canopy by fire or cutting, or prolonged flooding of the root zone. A follow-up application of a herbicide into the root crown is often necessary.

Noxious weeds known to occur in Nye, Lincoln, or Clark counties include poison hemlock, Russian knapweed, spotted knapweed, tall whitetop, dalmatian toadflax, whitetop, Canada thistle, musk thistle, and Scotch thistle. Details about the identification, origin, history, distribution, potential for invasion, ecology, and management of these species are in Sheley and Petroff (1999). Numerous biennial thistles have been observed, but not identified to the species level. Most of the other state-listed noxious weeds could potentially establish in the planning area.

Invasive Species

Cheatgrass, red brome, halogeton, and Russian thistle are four invasive species that inhabit the planning area. Other species may occur, but have not been identified. The ecological effect from all invasive species depends on their ability to expand their distribution, increase their abundance, and adversely affect ecological processes.

Cheatgrass has the widest distribution, being found throughout the northern planning area. Red brome appears restricted to the valley bottoms and alluvial fans, particularly, in the southern planning area. Both brome grasses are strongly affiliated with natural and anthropogenic disturbances. They also occur in undisturbed habitat, but usually at low densities. Halogeton appears restricted to two environmental conditions: 1) regularly or severely disturbed sites without a perennial plant component; and 2) undisturbed sites with saline soil and low cover from native perennial species. Halogeton is often widespread in shadscale communities around the margins of playas. Russian thistle also appears restricted to two general environmental conditions: regular and/or severely disturbed sites with few or no perennial plants; and sites with sandy soil and a naturally low density of perennial plants. For all four species, the BLM has no site-specific data about potential correlations between weed distribution and/or abundance, disturbance and other habitat variables (e.g., slope, aspect, elevation, soil, landform).

Ecology of the Invasive Species on the NTTR

Cheatgrass: Cheatgrass is the most widespread annual grass in Great Basin ecosystems (Stewart and Hull, 1949; Klemmedson and Smith, 1964; Hunter, 1991). It evolved in Eurasia, where acute and chronic anthropogenic disturbance has occurred for thousands of years. Evolution with anthropogenic activities has predisposed cheatgrass for rapid colonization when vegetation and soils are disturbed.

Cheatgrass germinates in the fall (September-December) after as little as one-half inch of precipitation (Beatley, 1966). Fall germinating plants become winter dormant but resume spring growth before seed from perennial plants germinates, and/or dormant perennials resume growth (Beckstead et al., 1993; Harris, 1967). Cheatgrass' growth and quick root elongation provide a strong competitive advantage (Harris, 1967; Hironaka, 1961; Monsen, 1994). Early and rapid growth, both above and below ground, allows cheatgrass to respond to optimum growing conditions quicker than desired species.

Cheatgrass plants may produce hundreds to thousands of seeds per plant in wet years, and less than one seed per plant during dry years (Young et al., 1969a). Cheatgrass density often has an inverse relationship with reproductive output per plant (Hulburt, 1955; Young et al., 1969a; Young and Evans, 1978). Effective measures that reduce cheatgrass density may be compensated for with substantially higher reproductive output per plant (Hulbert, 1955; Young et al., 1969a).

Manipulating the population dynamics of cheatgrass to control its abundance, must address the seed bank (viable seed reserve in the soil and litter across growing seasons). Most cheatgrass seed can germinate within two weeks of dissemination (Young et al., 1969b), and usually germinates within one year (Hulburt, 1955; Klemmedson and Smith, 1964). Despite high germination rates, the large number of disseminated seeds ensures a substantial carryover of viable seed between years (Young et al., 1969a). Effective control requires reducing both plant density and reproductive output, for several years.

Most seeds that germinate are in plant litter under plant canopies, particularly shrubs (Young and Evans, 1975; Young et al., 1969a; Evans and Young, 1970). Seed located on bare (mineral) soil has very poor germination, and requires coverage from mineral soil or plant litter (Evans and Young, 1970;Young et al., 1976). Seed also germinates well in cracks in the soil (Evans and Young, 1972). The specific germination requirements result in fewer seedlings in interspaces between plants, and disproportionately increases seedling density under shrubs, where litter cover is normally much higher and deeper (Young and Evans, 1975). The density of cheatgrass seedlings on bare-ground, however, appears to increase substantially with increased soil disturbance (e.g., shallow burial), or increased heterogeneity at the microtopographic level (Evans and Young, 1972). Seed located on top of mineral soil, that normally would not germinate, becomes covered with mineral soil, benefitting soil-seed contact, hence germination potential.

Nitrogen (N) availability is important for maintaining cheatgrass populations (McLendon and Redente, 1991; 1992; 1994; Young et al., 1997). Increased N availability prolongs the period of cheatgrass dominance. Decreased N availability increases desired perennial species, and decreases cheatgrass. Native plants in the Great Basin evolved with low levels of available N, and grow well with that limitation. Cheatgrass, evolved with chronic disturbance, and soil disturbance promotes N mineralization, increasing its availability.

Halogeton: Halogeton is a summer annual. Seed germination begins in late spring and/or early summer. Each plant can produce thousands of seeds. Halogeton typically grows best on sites where disturbances have removed most or all of the vegetation, and/or altered soil structure (Astroth and Frischkneckt, 1984). Undisturbed sites may have a low to moderate abundance of halogeton; however, monocultures of shadscale, winterfat, and other shrubs that are subject to periodic massive die-offs are subsequently colonized by halogeton. Undisturbed sites with halogeton typically have a high salt content, a low density of desired perennial species, and a physiographic location near playas or lagoons of former Pleistocene lakes.

The ability to photosynthesize during summer drought results from the accumulation of oxalates and other salts in the fleshy leaves. Subsequent decomposition can increase the amount of oxalates and other metabolites at or near the soil surface. Where halogeton has a very high abundance for a prolonged period, ecologists have speculated it alters soil chemistry, sufficient to reduce or eliminate the germination and/or establishment of desired species (Harper et al., 1996).

Russian thistle: Russian thistle is also a summer annual. Growth generally begins about April, and continues throughout the summer (Young et al., 1972). A mature plant can disseminate 100,000+ seeds (Robbins et al., 1952).

Russian thistle is a relatively non-competitive species, and has a high abundance only on sites with severe and/or regular disturbance. It may establish on undisturbed sites with sandy soil,

but apparently does not adversely affect desired perennial species. Sites with saline soil generally do not have a high abundance of Russian thistle, regardless of disturbance history and plant density. Locations infested with Russian thistle that are not repeatedly disturbed often have a decline in thistle after several years, and an increase in desired perennial species, provided a viable seedbank is present. The initial rapid increase in Russian thistle appears to sequester available inorganic N, which facilitates an eventual increase in native perennial species adapted to low nitrogen availability (McLendon and Redente, 1994).

3.6.3 RIPARIAN RESOURCES

There are no riparian areas in the southern planning area. The northern planning area has one short perennial stream (Breen Creek), and at least 64 springs and seeps. Several man-made ponds with small riparian areas also exist.

In the past, Breen Creek was heavily grazed by wild horses throughout the growing season. However, as a result of reductions in horse numbers over the past several years, horses have not been using Breen Creek as intensively. A small quantity of water is piped from the creek several miles downslope to a trough at a corral area. The availability of water outside the narrow riparian corridor has decreased forage utilization and trampling by horses, allowing the stream to be assessed in June 2001 as being in properly functioning condition (PFC). Water flows have not been measured across time, however, during the PFC assessment the stream channel with water was approximately 2 miles in length.

Springs and seeps in the Groom Range, Belted Range, and on White Bloch Mountain were all developed for use by livestock (current and historic) or for domestic supply (ranch house for D4 Enterprises). Some small springs have completely lost their riparian area, but most have some riparian area. None has exclosures present, thus grazing occurs throughout the growing season. Proper functioning condition assessments have not occurred on any springs in these areas, but all are degraded to varying degrees. Cattle grazing currently occurs only in the Groom Mountain Range; horses graze over the North Range from the Belted Range westward.

All springs on the west side of the Belted Range, Kawich Range, Cactus Range, and Stonewall Mountain have been affected by wild horses during the past 30 years. Excessive grazing by wild horses has degraded most, if not all riparian areas in these mountain ranges (Dames and Moore, 1996). Prior to extensive use by wild horses many of these springs and riparian areas were manipulated to support livestock or mining operations. None of these springs supports large riparian areas, but all are important sources of water and forage for wildlife. Only riparian areas in the Cactus Range have been fenced to exclude wild horses, and none has had water piped outside the exclosures for wild horses. Springs on Pahute Mesa, near Tolicha Peak, are not known to have been affected by wild horses. Most apparently support small, but high quality riparian areas. The BLM has conducted Proper Functioning Condition assessments on only nine riparian areas in the northern planning area. Data are on file with the Las Vegas Field Office.

3.6.4 SENSITIVE SPECIES

The United States Congress attempted to prevent human induced extinction when it enacted the Endangered Species Act (ESA) of 1973 (Public Law 93-205). The ESA provides legal protection to plant and animal species that are approaching extinction. Section 7 of the ESA states:

> "... Federal departments and agencies shall. . . [conduct] programs for the conservation of endangered species and threatened species . . . by taking such action necessary to insure that actions authorized, funded, or carried out by them do not jeopardize the continued existence of such endangered species and threatened species or result in the destruction or modification of habitat of such species . . ."

Proper interpretation and implementation of the ESA and its associated regulations require understanding of the following terms:

1. Threatened Species are species likely to be classified as endangered in the foreseeable future, if present population trends continue. The threat of extinction, while present, is less than for endangered species. Populations often are declining, or if stable, usually are small and/or have a restricted distribution. Threatened species are legally protected.

2. Endangered Species face imminent extinction throughout all, or a significant portion of a species geographic range, which is often limited. Endangered species are legally protected.

3. Candidate Species are species for which the USFWS has sufficient information about their vulnerability to extinction, to support listing the species as threatened or endangered. Listing as threatened or endangered is precluded due to other listing priorities. Candidate species are not legally protected; however, the USFWS encourages they be provided consideration equal to threatened and endangered species during the land management planning process.

4. Species-of-Concern (SOC) are species formerly classified as category 1 or 2 candidate species, or species protected by the State of Nevada. Species-of-concern generally have (or are perceived to have) a limited distribution, few populations, low densities, and/or a declining population size. Their perceived rarity suggests they are likely to become candidates for listing as threatened or endangered, but the USFWS requires additional information to justify legal protection. Federal agencies generally have regulations or policies that provide SOC the same protection as listed species.

5. Sensitive Species: A generic, inclusive term that refers to threatened species, endangered species, candidate species, and SOC.

Human activities superimposed on a species with only a few small populations, and limited geographic distribution, may have direct or indirect effects that increase the risk of extinction (Given 1994). Among the human activities known to increase the risk of extinction are: land conversion; dam construction and subsequent inundation; soil compaction or disturbance; erosion; mining; sand and gravel quarrying; draining and filling wetlands; groundwater withdrawal that changes the depth to groundwater; improper grazing management from authorized livestock, feral ungulates, and/or wildlife; chemical sprays; altered fire cycles; altered nutrient cycles; introduced species and diseases; recreation, including off-road vehicles, skiing, and trampling; introduced (altered) and natural vegetation change (succession); collection (commercial, recreational, and scientific); vandalism; and direct and indirect elimination of symbionts, pollinators, and dispersers (Falk, 1997; Givens, 1994). Each sensitive species may have a different population level response to the same human activity. Also, each species may have a similar response when the activity occurs at one frequency or intensity level, and a differential response at other frequencies or intensities. Anthropogenic activities may not cause direct mortality, but may weaken most members of a population, depressing its resilience to natural processes (e.g., fire, drought, insects, disease: Givens, 1994). Such indirect effects are among the most difficult to determine.

Sensitive species, both floral and faunal, that are know to occur, or are expected to occur, on the NTTR are summarized in Table 3-7 and in Appendices C and D.

3.6.4.1 **Flora**

No plant species known to occur in the planning area have been listed by the USFWS as threatened or endangered. Clokey eggvetch (*Astragalus oophorus* var *clokeyanus*) was recently downgraded from candidate status (64 FR 57544, October 25, 1999). Several populations are located on the west slope of the Belted Range.

Table 3-7. Threatened, endangered, and sensitive species known to occur, or expected to occur in the planning area.

Species	Federal Status	Nearest Known Location	Season of Use	Preferred Habitat
American bald eagle *Haliaeetus leucocephalus*	Threatened	NTS and DNWR	Fall and spring migration	Shorelines, lakes, wetlands, rivers
Peregrine falcon *Falco peregrinus*	SOC	NTS and DNWR	Year-long	Coasts, mountains, and woods
White-faced ibis *Plegadis chihi*	SOC	NTS, DNWR, Emigrant Valley	Fall and spring migration	Shorelines around lakes, marshes, etc.
Long-billed curlew *Numenius americánus*	SOC	NTS and DNWR	Fall and spring migration	Marshes, mudflats, meadows, and pastures
Mountain plover *Charádrius montanus*	SOC	NTS	Fall and spring migration	Short grass prairie or sagebrush
Snowy plover *Charádrius alexandrinus nivosus*	SOC	NTS	Fall and spring migration	Sand flats and alkali ponds
Least bittern *Ixobrychus exilis hesperis*	SOC	Pahranagat Valley	Fall and spring migration	Wetlands and small ponds
Northern goshawk *Accipiter gentilis*	SOC		Fall and spring migration	
Black tern *Chlidonias niger*	SOC	Pahranagat Valley	Fall and spring migrant	Wetlands
Burrowing owl *Athene cunicularia*	SOC	NTTR and NTS	Migrant and resident	Salt Desert shrub, Transition Desert scrub, Mojave scrub
Plainopepla *Plainopepla nitens*	SOC	NTTR	Year-long resident	Mojave Desert scrub, desert springs
Ferruginous hawk *Buteo regalis*	SOC	NTS	Potential year-long, but also fall and spring migration	Sagebrush plains and juniper savannahs
Desert tortoise *Gopherus agazziaii*	Threatened	South Range	Year-long	Piedmont fans, alluvial fans, and lower foothills
Banded Gila Monster *Heloderma suspectum cinctum*	Threatened (State)	South of NTTR	Year-long	Mojave Desert scrub
Chuckwalla *Sauromalus obesus*	SOC	South Range and southern NTS	Year-long	Rocky hillsides and rock outcrops within Mojave Desert community types

Many floral SOC (Appendix E) have populations on and/or near the planning area. All of these inhabit locations with habitat characteristics (e.g., plant community, soil, parent material) similar to those in the planning area. Some SOC probably have unidentified populations in the planning area,but they have not been located because ground-based training and testing activities have not occurred near their locations. Botanical surveys for all potential SOC have not occurred in most of the planning area (Knight and Smith, 1994; 1995; Knight et al., 1997).

3.6.4.2 **Fauna**

Exclusive of bats (covered separately below), there are 15 sensitive faunal species that occur or may occur (resident, incidental, or migratory) in the planning area (Table 3-7). They include 12 avian and 3 reptile species.

Avifauna

The American bald eagle (*Haliaeetus leucocephalus*) and the peregrine falcon (*Falco peregrinus*) occur very rarely, if ever, in the planning area. The bald eagle was recently downgraded from endangered to threatened status. The peregrine falcon has been de-listed. Both species remain SOC because of their high political visibility and potential use as indicator species.

Bald eagles are primarily winter residents in Nevada, and are closely associated with wetland, lake, and riverine habitats. The nearest known overwintering site is Pahranagat Valley. Bald eagles have infrequently been sighted on the NTS and the DNWR, during the spring and fall migration.

The peregrine falcon is a rare year-round resident on both the DNWR and the NTS. Historic nest locations include the Pahranagat, Las Vegas, and Pahrump Valleys (Herron et. al., 1985). The NDOW is attempting to re-establish peregrine falcons as a breeding species in Nevada, which may result in establishing a population in the planning area. Peregrine falcons prefer rocky cliffs for building nests. Few, if any, ground-based activities in the planning area are located near cliffs.

The osprey has habitat requirements similar to those of the bald eagle. The infrequent occurrence of bald eagles in the region suggests that osprey's are a rare visitor during migration.

The mountain plover (*Characrius montanus*) is a candidate species for listing as threatened or endangered. It is a rare spring and fall migrant in southern Nevada. None has been observed in the planning area. Mountain plovers prefer the short-grass prairie and sagebrush habitats located north and east of Nevada.

The white-faced ibis (*Plegadis chihi*), long-billed curlew (*Numenius americanus*), and snowy plover (*Characrius alexandrinus nivosus*) are SOC that may infrequently use habitat in the planning area. The white-faced ibis and the long-billed curlew typically inhabit meadow, marsh, or wetland habitat. The snowy plover prefers sandy alkaline flats. Individual patches of meadow, riparian, and marsh habitat in the planning area are small (<3 ac), widespread, and typically located in the higher mountains. They probably cannot support resident populations of these species. Alkaline flats are present on the playas.

Bats

Thirteen bat SOC are known to occur in southern Nevada. They are: Mexican long-tongued (*Choeronycteris mexicana*), California leaf-nosed (*Macrotus californicus*); Southwestern cave myotis (*Myotis velifer brevis*); spotted (*Euderma maculatum*); Greater western mastiff (*Eumops perotis californicus*); Western small footed myotis (*Myotis ciliolabrum leibii*); Yuma myotis (*Myotis yumaneneis*); long-legged myotis (*Myotis volans*); fringed myotis (*Myotis thysanodes*); long-eared myotis (*Myotis evotis*); Townsend's big eared (*Corynorhinus = Plecotus townsendii*); Allen's brown (*Idionycteris phyllotis*); and the Big free-tailed (*Nyctinomops macrotis*). Two species, the Mexican long-tongue and the Big free-tailed, are vagrant or incidental species in Nevada. Their occurrences

have been very rare, and there are no records of breeding in Nevada. This suggests they are neither regular year-long nor seasonal residents, but infrequent visitors, for unknown reasons.

The spotted bat has become a high profile species of concern. It is widely distributed throughout western North America, from British Columbia to Mexico. The nearest known location is Pahute Mesa, on the NTS (EG&G, 1993; Steen et al., 1997). The spotted bat typically has a low population density (Fenton et. al., 1987; Watkins, 1977), although it can be locally abundant (Easterla, 1973; Leonard and Fenton, 1983). Spotted bats are suspected to roost in cracks of cliff faces and canyon walls, and have been found in a wide variety of habitat, from desert shrub to coniferous forests. Suitable roost sites and foraging habitat occur in the planning area.

Numerous species either are, or are thought to be, summer migrants. They regularly use habitat in southern Nevada during the warm summer months, but move to Arizona, New Mexico, Texas, or Mexico during the winter. Of these, the California leaf-nosed, greater western mastiff, Yuma myotis, and Allens are found only in extreme southern Nevada, south of the NTTR. The southwestern cave myotis and spotted bats are known to occur in habitat similar to that of the planning area during the summer, but not winter. The remaining species use habitat types throughout Nevada in the summer, but little is known about their migratory patterns. Some may not migrate at all, but hibernate to avoid adverse climatic conditions.

Bats use a wide variety of habitats (Appendix D) over a wide elevation range. Several general patterns are evident. First, water sources are a focal point. For all SOC, the literature suggests a strong affinity for perennial water sources to meet foraging and drinking requirements. For non-SOC, the importance of water is mentioned less often (in the literature). This may reflect a lack of knowledge, not a decreased importance of water, because non-SOC have been studied less. Second, almost all species roost in a limited number of habitat types. Common roosting structures include abandoned mine tunnels, caves, crevices in cliff faces, buildings (often abandoned), the undersides of bridges, rock shelters, old nests of barn swallows, behind loose bark in trees, and cavities in tree trunks. Third, some species use colonial roosts, while others prefer solitary roosts; but there are insufficient data for all species that may occur in the planning area.

Desert Tortoise

Desert tortoises are confined to the southern part of the planning area (Figure 3-9), and are considered "an indicator species to measure the health and well-being of the ecosystem it inhabits" (Berry and Medica, pg. 135, 1995). They spend the majority of their lives underground, in winter dens and summer burrows. Underground shelters are susceptible to surface-disturbing activities that collapse entrances, and trap and suffocate the occupants. Tortoises generally remain in winter dens between October and mid-March, emerging to feed and mate during late winter and early spring. They typically are active above ground through the spring. Tortoises use both burrows and shrub cover to avoid high summer temperatures. During the summer months, activity is concentrated at sunrise and sunset, when the animals leave their burrows to feed.

Tortoises are long-lived, mature slowly, and have low reproductive rates. Longevity compensates for their high annual variation in reproductive success, which is correlated with environmental conditions. Detailed information about desert tortoise life history can be found in Woodbury and Hardy (1948), Hohman and Ohmart (1979), Berry (1984b), Nagy and Medica (1986); Esque (1994), and Berry and Medica (1995).

Desert Tortoise Nutritional Requirements: Desert tortoises consume grasses, flowers, and succulent plants (Grover and DeFalco, 1995). Food habits depend on the vegetative composition of their habitat (Burge and Bradley, 1976). In southern Nevada, forage selection in the spring is largely forbs, (e.g., *Camissonia munzii* and *Langloisia setosissima)* and small amounts of grass(Nagy and Medica, 1986). Most forbs have dried by mid-June, and grass consumption (largely red brome and

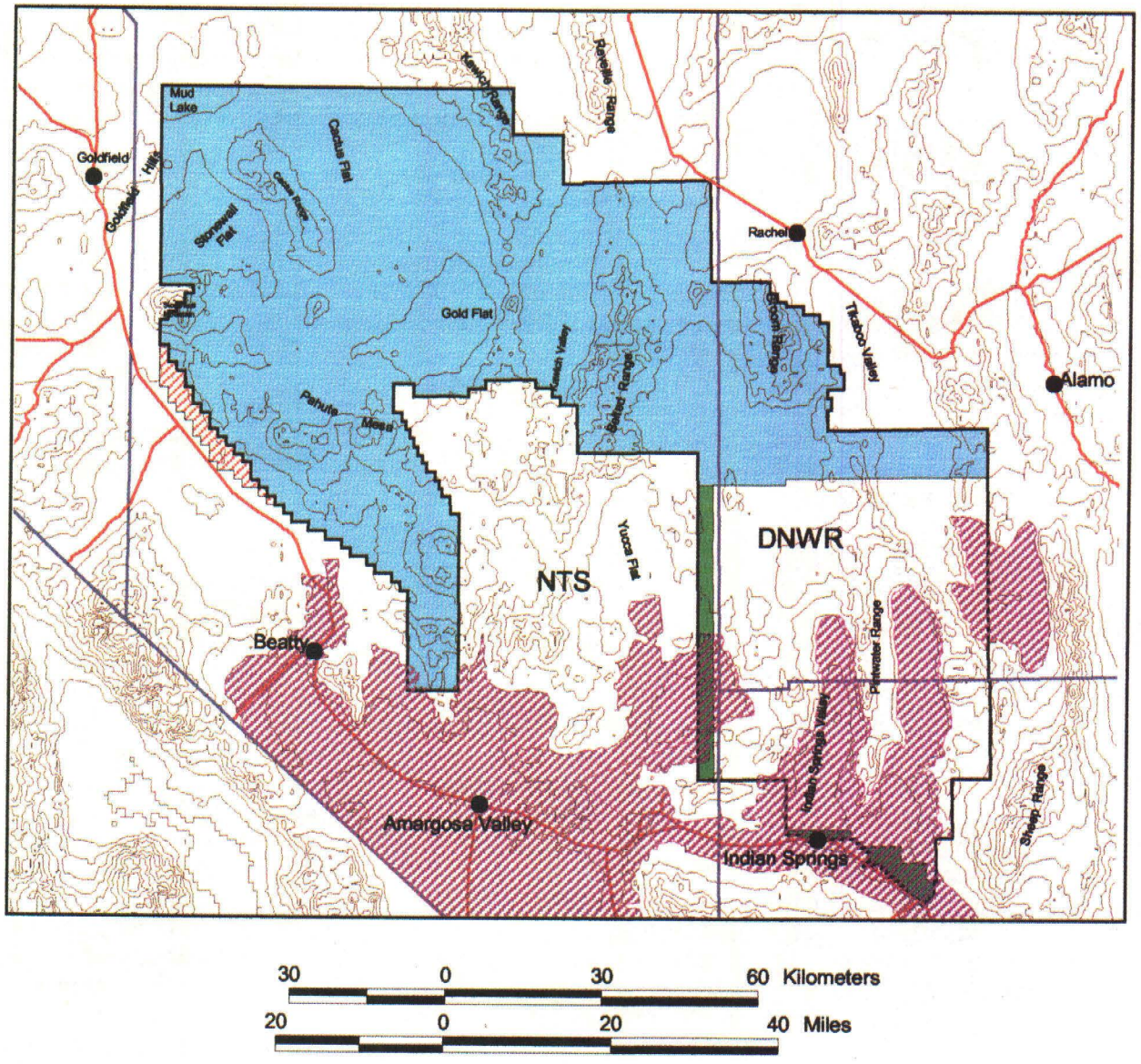


Figure 3-9. Desert tortoise habitat.

Indian ricegrass) increases. Dry *Langlosia* often becomes important in late summer. If summer rains facilitate regrowth of *Camissonia*, red brome, and Indian ricegrass, tortoises will consume the green shoots (Nagy and Medica, 1986). Tortoises may consume cutleaf filaree (*Erodium cicutarium*) and bush muhly (*Muhlenbergia porteri*) throughout the year (Coombs, 1977). Other spring and summer forage includes island Indian wheat, shaggyfruit pepperweed (*Lepidium lasiocarpum*), beavertail pricklypear (*Opuntia basilaris*), blackbrush, *Cryptantha spp.*, and *Eriophyllum spp.* A more complete list of forage items is in BLM (1999).

Adult tortoises require approximately 23 pounds of forage per year. Forage quality, however, may be more important than forage quantity (Oldemeyer, 1994). Few forage species supply a good balance of nutrients. Consumption of a variety of forage items is important (Mayhew, 1968). In the spring, native forbs are particularly important because they contain essential nutrients that are easily digested and absorbed (Fowler, 1976; Hohman and Ohmart, 1980; Urness and McCulloch, 1973). Perennial grasses appear important in the late summer, as a source of water and nutrients. Green shoots in the perennial grasses provide water that can prevent dehydration and the buildup of electrolytes,(Coombs, 1977; Woodbury and Hardy, 1948). Following dry winters, annual forbs and grasses are virtually absent. Perennial grasses may be the primary source of both water and nutrients.

Desert Tortoise Habitat Requirements: Landforms, soil physical properties, and vegetative characteristics interact to create suitable habitat for desert tortoises. Soil properties must be suitable for digging burrows to an average depth of 20 in. Rock content, soil texture, and depth to a restrictive layer are all soil physical characteristics that influence suitability for burrowing (Wilson and Stager, 1989).

Landforms create micro-environments with varying degrees of habitat suitability. Dissected landforms (i.e., cut by drainages) create more diverse micro-environmental areas. Ephemeral washes often expose caliche layers that tortoises can burrow beneath.

In Nevada, tortoises are found in creosote, creosote-bursage, and creosote-blackbrush communities on bajadas, hills, or caliche washes (Lucas, 1978; 1979; Tanner and Jorgensen, 1963), usually below the 4,000 ft elevation contour (Karl, 1981). The creosote bush-bursage community is the most productive tortoise habitat (Burge, 1979; EG&G/EM 1991; Grover and DeFalco,1995; Karl,1980;1981); however, plant communities with high densities of annual and perennial herbaceous flora, high primary production in the spring from annual flora, and high vegetation cover typically support high densities of tortoises (Berry, 1975; Karl, 1981; Luckenbach, 1982; Schwartzmann and Ohmart, 1978). Tortoise density appears to be positively correlated with creosote bush and negatively correlated with a high abundance of blackbrush and red brome (Karl, 1980; 1981). Flat gravelly and rocky areas are poor tortoise habitat due to limited burrowing potential (Garcia et al., 1982).

Regional Trends in Desert Tortoise Populations: Tortoise populations in the planning area have not been monitored. It is unknown if they are increasing, decreasing, or remaining static. Throughout the region tortoise densities have declined where habitat quality or quantity has declined (Berry and Medica, 1995; Bury et al.,1977; Bury and Luckenbach, 1986). While there was no apparent downward trend in relative abundance of adult tortoises in the eastern Mojave, there was a decrease in the relative abundance of juvenile tortoises (NERC, 1990).

Factors Known to Influence Desert Tortoise Numbers: Processes that can decrease tortoise population size include disease, malnutrition, predation, and human activities. Osteoporosis (shell necrosis) was documented on all Nevada permanent study plots sampled between 1990 and 1992. Osteoporosis may make individual animals less able to withstand attacks by predators. It may also be symptomatic of an individual that has an increased susceptibility to other diseases or environmental stress. The second disease causing desert tortoise mortalities is an upper respiratory

tract disease that is both highly contagious and often fatal. This condition has been documented east of the planning area in Coyote Springs Valley, but not in the planning area.

Dietary stresses could account for increased incidences of malnutrition, greater susceptibility to disease, and lowered reproduction rates. Malnutrition has been implicated as a direct or indirect cause of declining tortoise populations, by increasing mortality rates and reducing reproduction rates (Borysenko and Lewis, 1979). Malnutrition may occur when native annuals and herbaceous perennials (such as bush muhly) are replaced by exotic annual plants that are nutritionally inferior. (Coombs, 1979). The presence or absence of malnutrition in tortoises in the planning area has not been studied.

Ravens (*Corvus corax*) are the primary predators on tortoises, although golden eagles (*Aquila chryaetos*), red-tailed hawks (*Buteo jamaicensis*), burrowing owls (*Athene cunicularia*), roadrunners (*Geococcyx californianus*), coyotes (*Canis latrans*), kit fox (*Vulpes macrotis*), and badgers (*Taxidea taxus*) will consume tortoises (Woodbury and Hardy, 1948; Mortimore and Schneider, 1983; Berry, 1988). Raven populations in the Northeastern Mojave Recovery Unit and on the southern planning area have increased in tandem with urbanization and human activities. The birds forage in garbage dumps, along highways, and roost or nest on power transmission towers and power lines. Data from the southern planning area, however, are currently insufficient to quantify the effects of predation on desert tortoise population.

Construction, mining, OHV use, vandalism, and illegal collection also contribute directly and indirectly to high tortoise mortality. Individual tortoises are injured or killed by vehicles and heavy equipment, both along highways and off-road. Tortoise burrows with eggs may be crushed. The indirect effects from human activities include habitat loss and fragmentation that can affect mortality rates for specific populations.

Designated Critical Habitat: The USFWS has not designated critical habitat in the southern planning area.

Chuckwalla and Gila Monster

The chuckwalla lizard is a BLM sensitive species. Chuckwallas are large, herbivorous lizards, generally found at elevations below 5,000 ft on rocky outcrops and slopes. Suitable habitat for chuckwallas includes most mountain ranges in southern Nevada. The southern planning area ridges and alluvial fans contain rocky outcrops of the type that chuckwallas inhabit.

The Gila monster has been found only at locations south of the planning area. Its preferred habitat type, however, is Mojave Desert Scrub, which is the most common vegetation association on the southern planning area.

3.6.5 WILDLIFE HABITAT

Implementation of a wildlife management program covers two areas: manipulation of the habitat to benefit wildlife populations and the regulation of the population size. Federal agencies are charged with managing habitat in the planning area, while the NDOW has jurisdiction over population regulation. State wildlife biologists determine the appropriate population level for the target species (usually with input from the land management agency) in defined management units, and manipulate population size, largely through regulated hunting and/or trapping. Air Force security requirements prevent hunting and trapping in most of the planning area; therefore, wildlife populations rise and fall according to changes in habitat availability and quality (i.e., water, food, and hiding and thermal cover). Without the ability of the state or the Air Force to actively (directly) regulate population size, wildlife management can only address habitat issues. This section, accordingly, focuses on habitat management.

Habitat loss can be both quantitative and qualitative. A quantitative loss results from the direct reduction or elimination of one or more critical habitat elements (i.e., food, water, or cover). Construction activities are the most common cause of direct habitat loss. Human activities that eliminate or reduce access to surface water and/or riparian habitat will have the largest negative influence on wildlife populations. Conversely, human actions that create a drinkable water supply should benefit wildlife populations.

A qualitative change in wildlife habitat occurs when habitat elements (water, food, or cover) remain, but their abundance, distribution, or quality change. For example, primary production (i.e., potential forage) may remain constant, but the species composition changes to one dominated by plants that are less nutritious or palatable. Lower nutritional quality results in smaller populations, thus, the site has undergone a qualitative decline. Quantitative and qualitative habitat changes are most critical when they affect the most limiting habitat element, which for most of the planning area is water distribution. Most water sources are in the Groom Range, but their density is low (< one per 4 mi^2), and they are poorly distributed. There are only a couple of very widespread perennial sources in the Belted Range, Chalk Mountain, Pahute Mesa, Tolicha Peak, and Stonewall Mountain. The northern Kawich Range and Cactus Range have more water sources, but they cannot be considered abundant, and flows vary considerably between years. There are no perennial water sources in the southern planning area. The valleys in the northern planning area lack natural perennial flows. Pipelines have extended flow to several water troughs (Rose Spring and the Corral) in the north end of Cactus Flat. Ephemeral sources are available on the playas during wet years, and at both natural and human developed ponds.

There have been no quantitative inventories and assessments of habitat in the planning area for any wildlife species, or regular monitoring of habitat composition and structure. The quantity and quality of habitat for most species is unknown, as are how past and future development in the planning area may directly and indirectly affect most wildlife.

3.6.6 FORESTRY/WOODLANDS

3.6.6.1 **Forestry Products**

There are no commercial forests on the NTTR. Pinyon-juniper (PJ) (*Pinus monophylla* and *Juniperus osteosperma*) woodlands are found on the taller mountain ranges on the North Range. No PJ woodlands are found on the South Range. Pinyon-juniper woodlands are not capable of supporting a commercial lumber industry. Throughout the Great Basin, PJ woodlands typically provide fuelwood, fence posts, and pine nuts. The harvest of these products on the NTTR is not allowed due to safety (live ordnance on overflying planes) and security constraints. A description of the PJ woodlands and their ecology is located in the Section 3.6.2.1.

3.6.6.2 **Fire Management**

A review of aerial photography and Thematic Mapper satellite imagery (30-m-pixel resolution) indicates numerous wildfires have burned on the NTTR. Small to medium (several to hundreds of acres) fire scars are common in both the Pinyon-Juniper woodlands on the Groom Range, and in other areas of Emigrant Valley. In the late 1980s one fire burned over 20,000 acres in the northern end of Emigrant Valley near Chalk Mountain. Other large fire scars are evident near Black Mountain and west to Tolicha Peak.

In the PJ woodlands and sagebrush vegetation types, wildfire typically occurred with frequencies ranging from between 8 and 100+ years prior to about 1860 (Gruell, 1999). The site-specific frequency depended on the site's potential to return to a successional state with high biomass accumulations, and continuous fine fuels. Locations with deep soil and relatively high average annual precipitation (or effective precipitation) often had high annual production from perennial grasses several years after a fire, resulting in short fire frequencies. The salt desert shrub type is not

believed to have been strongly influenced by wildfire, and may not have had any evolution with wildfire.

Climate change, grazing by both domestic and feral ungulates, and subsequent fire suppression are all believed to have lengthened fire cycles. Flammable, herbaceous fuels between scattered shrubs and trees declined, reducing the ability of the vegetation to carry a fire. Woody range sites (shrub and tree) often have become dominated by decadent shrubs and/or trees, without a herbaceous understory.

Much of the PJ woodland on the North Range has a closed canopy, or is approaching closed canopy status. Table 3-8 defines the various canopy cover classes. Closed canopy PJ woodlands are susceptible to large, catastrophic wildfires. The absence, or near absence, of a shrub-grass (perennial grass) understory in most PJ woodlands facilitates their invasion by highly flammable cheatgrass after wildfires. This potentially shortens the fire cycle (see Vegetation - PJ Woodland for more details). A similar condition exists in old, decadent stands of Wyoming sagebrush, a common plant association on the upper alluvial fans. Woodland and sagebrush sites with abundant perennial grasses and forbs in the understory recover quickly from periodic wildfire episodes. On the NTTR, land managers do not know which areas, if any, have a high potential for recovery from wildfire. Appropriate inventories for ecological status (i.e., successional stage and species composition) have not occurred, except perhaps on about 204,000 acres of the NWHR (SAIC, 1999). The mountainous terrain inhabited by woodlands was excluded from SAIC's (1999) study.

Table 3-8. Successional classes/phases developed by Blackburn and Tueller (1970).

Successional Class	Description
Closed	Essentially no understory below the stand of pinyon and juniper.
Dense	Abundant pinyon and juniper of all maturity classes with some sagebrush understory.
Scattered	Abundant pinyon and juniper seedlings, young saplings, and a few mature vigorous and mature old trees with a well-developed understory of black sagebrush and associated species.
Dispersed	Abundant pinyon and juniper seedlings, young saplings, and a few saplings and mature vigorous trees with a well-developed sagebrush understory.
Open	Essentially a sagebrush community with scattered pinyon and juniper seedlings and saplings, with a well-developed understory.

Fire is a spatially stochastic event in PJ woodlands that occurs each year, and can reach unpredictable size. To understand the effects of fire on PJ woodlands, one must understand interactions among elevation, slope, aspect, landform, and fire frequency, both before and after settlement (1850 onward). Also relevant is how fire influences plant succession, and how fire interacts with cheatgrass (Gruell, 1999; Koniak, 1986,;Tausch et al., 1981; Tueller et al., 1979; West et al., 1978). North aspects, swales, drainages, and hillsides with shallow slope usually have deep soil, and ***can*** produce the largest trees. Gruell (1999), however, found that pre-settlement fire was relatively frequent (8-20 years) on landscapes with deep soil. Locations with shallow, rocky soil had limited amounts of flammable fuel, and fire return intervals between 50 and 100 years, or longer. Prior to settlement, the initial vegetative colonizers following a fire were annual forbs and perennial grasses (annual grasses were absent from the system). Landforms with deep soil can hold more moisture; therefore, they have the potential to produce a substantial herbaceous biomass several years after a fire, facilitating a short fire return interval. Many sites remained treeless, or nearly so, because young PJ trees (< 50 years old) have high mortality from fire (Young and Evans, 1981).

After a fire, secondary succession towards a woodland is slow (Koniak, 1985). Twenty or more years can pass before trees begin to reestablish. The formation of well-developed woodlands takes 85 to 90 years or more (Barney and Frischknecht, 1974; Erdman, 1970).

Decreased fire frequencies since settlement have allowed trees to establish on landscapes where fire previously excluded them. Without fire, the density of PJ increases and understory biomass declines (Everett and Koniak, 1981; Tausch et al., 1981). Groundcover from understory species can fall below 3.5 percent (Everett and Koniak, 1981; St. Andre et al., 1965). Every 10 percent increase in woodland canopy cover results in a 50 percent decline in understory cover and biomass (Tausch and Nowak, 1999; Tausch and West, 1995). Eventually, the understory is almost totally lost, which probably eliminates (or nearly eliminates) the seed bank for desired grasses, forbs, and shrubs.

Less understory biomass in the PJ woodlands initially reduces the potential for wildfire. The long-term absence of fire, however, allows the woodland canopy to expand. The continuous understory fuels that were present before the historic expansion of the PJ woodlands are eliminated, but are replaced by a continuous layer of canopy fuels (West et al., 1998). The canopy fuels have a greater biomass, which facilitates crown fires (Gruell, 1999; Tausch, 1999). Each canopy fire can eliminate thousands of acres of mature woodland in one day. The effect on nutrient storage is long-term (Klopatek, 1987), and is magnified further if cheatgrass occupies the site. Dominance by cheatgrass usually prevents secondary succession towards woody (shrubs or trees) vegetation (Billings, 1994).

The buildup in heavy fuels in PJ woodlands, the loss of the understory component, and the introduction of annual grasses collectively suggest that future fires will have numerous effects. First, the amount of area burned each year will continue to increase (Gruell, 1999, Tausch, 1999; West et al., 1998). The amount of acreage burned each year has been increasing since the 1970s (data from the National Interagency Fire Center, Boise, Idaho). Gruell (1999) used data from the National Interagency Fire Center to conclude that much of the area burned from 1978 through 1996 was PJ woodland, and that woodland fires are becoming larger. Second, large woodland fires are typically crown fires that result in complete volatilization of all small branches, leaves, duff, and litter. Very hot fires can eliminate large branches and the entire bole. Young trees and shrubs are absent, and the shrubby nurse plants that facilitate PJ establishment (Phillips, 1909) can take many years to establish, particularly if seed must emigrate from distant locations. Third, the introduction of cheatgrass has altered the evolved successional pathway, particularly at low elevation, xeric sites (Billings, 1994, Tausch et al., 1995). Cheatgrass can dominate disturbed xeric sites within several years, creating a continuous fine fuel. The rapid buildup in fine, continuous fuels facilitates frequent fires that prevent the re-establishment of woodlands or shrublands. The result is a permanent, or near permanent, change in land cover across much of the Great Basin and Intermountain West (Billings, 1994; Miller et al., 1999; Tausch 1999), including the planning area.

There are no bombing targets in the PJ woodland type. Most anthropogenic activities are limited to numerous roads, some electronic warfare sites, and communication sites. Two potential human sources of ignition include aircraft crashes and flares.

The Mojave Desert plant communities on the South Range are not believed to have evolved with frequent, or even infrequent fire (Humphrey, 1974). The expansion of the invasive annual grass, red brome (*Bromus madritensis* ssp. *rubens*), throughout most Mojave Desert plant associations located on alluvial landforms has increased the potential for wildfire throughout the South Range. The exception is where well developed desert pavements occur. When desert pavement covers most of the interspaces between relatively widespread shrubs, the density and biomass of annual grasses is insufficient to develop a continuous fuel source.

Mountainous areas on the South Range with shallow, rocky soil have been little affected by the expansion of either cheatgrass or red brome. These annual grasses are very minor components of most plant communities. Desired perennial grasses, forbs, and shrubs are common, and usually have insufficient biomass and density to create large areas with continuous fuel. Fires appear to have been very infrequent or very small. The potential for fires to spread rapidly after ignition is small to none. Vegetation mapping, inventories, and monitoring have been insufficient to determine which areas have relatively high and low potential for undesired wildfires.

Fire suppression on the NTTR is geared toward protecting lives and facilities at the widely scattered industrial complexes, not the suppression of wildfire. The response time for initial suppression in much of the planning area is long (1+ hours). On-site suppression forces are small, and a single large event, or a widespread outbreak of small fires (that potentially could become large) during a lightning storm, would require outside assistance for full suppression. The BLM has an indefinite agreement with Nellis Air Force Base that defines the responsibilities and authorities for fire protection services and support on the planning area. Restricted access in some locations, for security and/or safety reasons, however, further complicates suppression efforts.

3.6.7 LIVESTOCK GRAZING

The Air Force discontinued authorized livestock grazing on the NTTR in 1956 by purchase of the permits. Unauthorized grazing by as many as 8,000 cattle per year (duration unknown) occurred on the North Range until the mid to late 1970s, when a north boundary fence was completed (unpublished memos on file with the Nevada Wildhorse Commission). The Groom Range withdrawal was added to the NTTR in 1984. That withdrawal (PL 100-338: June 17, 1988) allowed D/4 Enterprises to continue grazing in the withdrawn portion of the Bald Mountain Allotment, "pursuant to applicable law and Executive Orders where permitted...." The renewal of the NTTR withdrawal in 1999 allowed the continuation of livestock grazing in the withdrawn portion of the Bald Mountain Allotment.

3.6.7.1 **Grazing Allotments**

Bald Mountain Allotment

The withdrawn portion of the Bald Mountain Allotment covers about 41,147 acres on the east flank of the Groom Range (Figure 3-10). The allotment also covers several hundred thousand acres outside the planning area. The elevation ranges from about 5,200 ft to 9,348 ft above sea level. The slope ranges from nearly level to well over 50 percent. Vegetation associations present include blackbrush, black sagebrush, Wyoming sagebrush, pinyon woodland, Utah juniper woodland, PJ woodland, mountain sagebrush, mountain mahogany and numerous small meadows and riparian areas. Detailed information about vegetation is discussed in Section 3.6.2.1.

Livestock or their sign were observed on all portions of the Bald Mountain Allotment during field surveys for the Groom Range withdrawal (USAF, 1985). Most forage utilization was concentrated on the mountain valley alluvial fans, and the canyon bottoms that drain from the main spine of the Groom Range. Two factors probably account for this. First, all permanent water sources are located near the juncture of the alluvial fans and the mountain block, or along pipelines located further east, toward Tikaboo Valley. Second, the sideslopes of the Groom Range are steep, often rocky, and frequently covered with dense PJ woodlands that provide minimal forage.

The BLM has categorized the Bald Mountain Allotment (both withdrawn and non-withdrawn portions) as a maintenance (M) allotment (BLM, 1990). The BLM considers the range condition satisfactory, with moderate to high resource potential, and that the current above-ground primary production is near its potential.

The authorized season of use (i.e., the grazing period) is form March1 through February 28 (BLM, 1990). While livestock can graze any part of the allotment (withdrawn or not withdrawn)

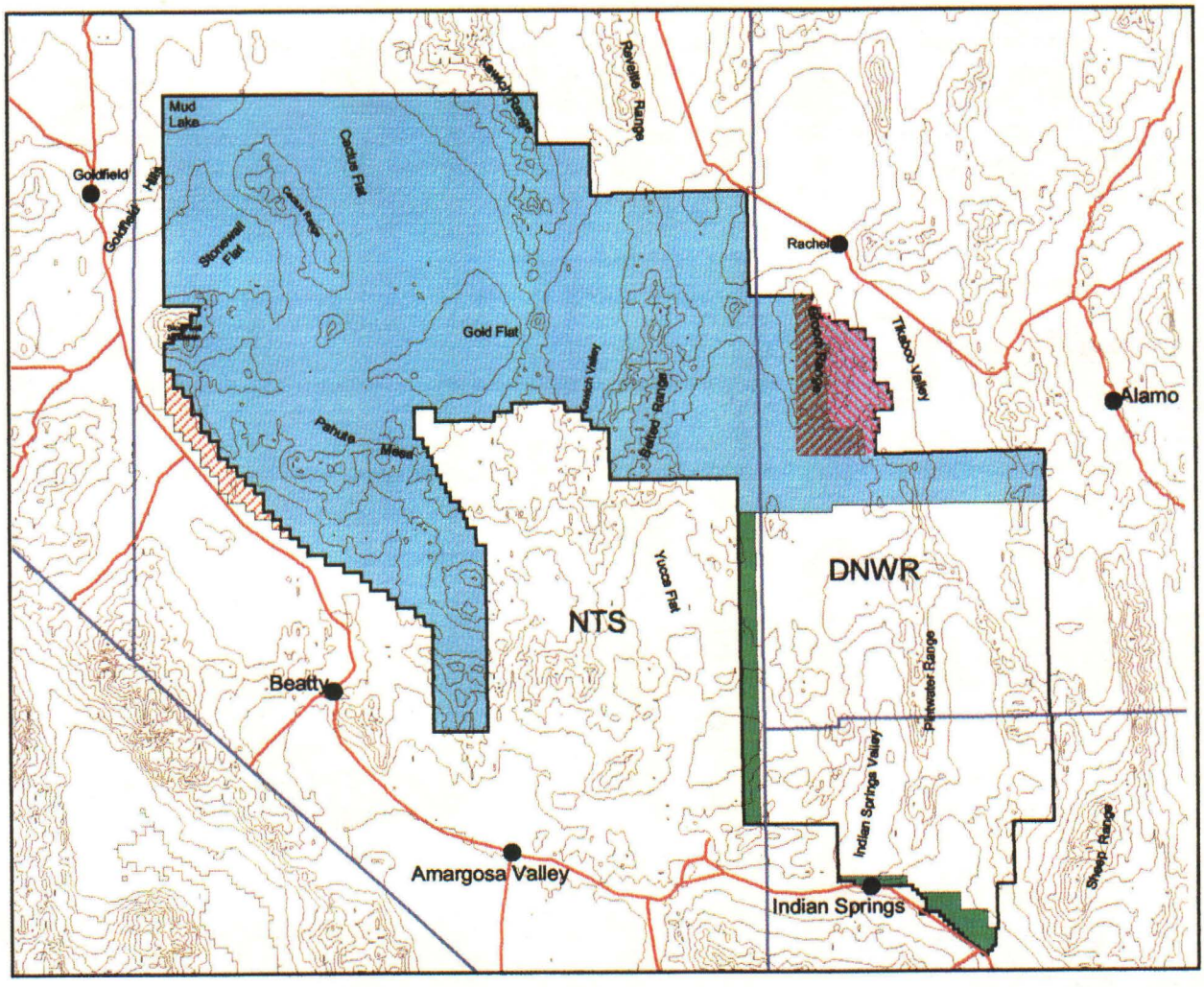


Figure 3-10. Livestock grazing allotments within the planning area.

during this period, not every acre is (or should be) grazed continuously during the period. The spatial and temporal extent of livestock grazing on the withdrawn area is largely unknown. Security constraints have reduced access for the BLM.

The BLM estimates that available livestock forage on the entire Bald Mountain Allotment is 5,811 animal unit months (AUMs) (BLM, 1979a; 1979b), with approximately 800 AUMs in the withdrawn portion (BLM,1990). The 800 AUM figure was derived by assuming that forage production is equal across the entire allotment, and allocating AUMs proportionately on the withdrawn and non-withdrawn areas. Forage production undoubtedly is not equal on all parts of the allotment. The higher elevations in the Groom Range result in more precipitation and cooler temperature (Houghton et al., 1975), which increases the effective moisture. More effective moisture should increase primary production in the Groom Range, compared to other parts of the allotment, which are largely located in Tikaboo Valley. Forage production and availability in the Groom Range, however may be less than in other parts of the allotment for two reasons. First, dense PJ woodlands cover much of the area. Every 10 percent increase in PJ canopy cover typically results in 50 percent decline in primary production from understory shrubs and grasses (Tausch and Nowak, 1999; Tausch and Tueller,1990; Tausch and West, 1995). Dense woodlands may sharply reduce forage production, and/or reduce livestock access. Second, the steep, rocky, topography limits livestock use of much of the area. Potential forage may be abundant on steep sites, but if it is not accessible, it is functionally unavailable. Much of the forage base in the withdrawn area may have a low probability of being selected. Accurate data about forage production (for wildlife or livestock), forage availability, the number and type of livestock, livestock distribution, season of use, forage utilization, and annual variation in these attributes are absent.

Naquinta Springs Allotment

The Naquinta Springs Allotment is located entirely within the planning area, on the west and south sides of the Groom Range (Figure 3-10). It covers about 52,425 ac, between about 4,500 ft and 9,348 ft. The physiography includes alluvial fans and fan piedmonts at the lowest elevations; moderately steep to steep foothills; steep mountain sides (>50%); and deep, narrow canyons. The vegetation includes all of the associations found in the Bald Mountain Allotment, plus Joshua tree (*Yucca brevifolia*) uplands and Transition Desert shrub-grass sites with a high abundance of spiny hopsage, wolfberry, Nevada Mormon tea, and Indian ricegrass. Plant communities on many of the mountain sideslopes, lower foothills, mountain valley fans, and alluvial fans are undergoing a rapid conversion to PJ woodland.

The Caliente Management Framework Plan (BLM, 1979a) lists annual forage production for livestock at about 1,058 AUMs. Permitted grazing has not occurred since1956, when the Air Force purchased the grazing rights. Because the Caliente Management Framework Plan did not allocate any forage to livestock, the BLM officially closed the allotment to livestock grazing in 1987. Livestock, however, continue to graze the allotment due to incidental (non-willful) trespass. Incidental trespass grazing cannot be eliminated because there is no boundary fence separating the Naquinta Springs and Bald Mountain allotments. A boundary fence would have to traverse the crest of the Groom Range. The rugged terrain makes construction of the fence prohibitively expensive. Also, heavy winter snowfall, strong winter winds, and soil creep make it difficult to maintain a fence as an effective barrier to cattle movements. Finally, strict access restrictions limit the ability of D4 Enterprises to use range riders and herding to keep cattle out of the Naquinta Springs Allotment.

Some cattle appear to graze the allotment much of the year, but probably are concentrated near water sources. Accurate data about forage production (for wildlife or livestock), the number of livestock, their season of use, livestock distribution, defoliation intensity (forage utilizaiton), and annual variation in these attributes are absent.

3.6.7.2 **Forage Utilization**

The BLM has not conducted on-site grazing evaluations on either the withdrawn portion of the Bald Mountain Allotment, or the Naquinta Springs Allotment, since before 1978. Ecological surveys conducted for the Air Force in 1985 indicate that cattle graze throughout the Groom Range, including the top of Bald Mountain (USAF, 1985). Detailed forage utilization maps were not developed, but observations indicated that forage utilization was particularly heavy around springs, in canyon bottoms, and uplands with shallow slope. Steep sideslopes immediately above the canyon bottoms generally had low utilization levels in 1985 (USAF, 1985).

3.6.7.3 **Existing Management Goals**

Grazing management in the Groom Range follows the NAFRRP and Record of Decision (USDI, 1990; 1992), and are outlined in Chapter 2. Numerous vegetation management objectives in the NAFRRP Record of Decision that include aspects of grazing management are also addressed in Chapter 2. Most of these objectives have not been met (details in Chapter 4).

3.6.8 WILD HORSES

Horses evolved in North America, but like much of the Pleistocene megafuana became extinct between 10,000 and 15,000 years ago. The equid herd in the northern planning area originated from introductions by Europeans in Nevada that began in the mid 1800s. Both horses and burros are extremely adaptive and can compete with each other, and with mule deer, pronghorn, bighorn sheep, and other fauna for forage, water, or space. The co-occurrence of horses and wildlife does not automatically confer that competition exists.

3.6.8.1 **Creation of the Nevada Wild Horse Range**

Wild horses and burros are protected under Public Law 92-195, the Wild Free-Roaming Horse and Burro Act of 1971 (WHBA). However, management of wild horses on the NTTR, predated the WHBA by nearly a decade. In June1962, through a cooperative agreement between the BLM Nevada State Director and the Commander of Nellis AFB, the NWHR was created. The original 435,000 acre area for the NWHR was reduced to 394,000 acres in June1965. The NWHR (Figure 2-1) is an administrative management unit established between the Air Force and BLM. An automobile survey in 1962 estimated 200 to 400 wild horses were on the NWHR, but there were no studies conducted to determine the wild horse use area prior to the establishment of the NWHR. After the passage of the WHBA in 1971, a new cooperative agreement, finalized in February of 1974, canceled and superseded the previous agreements, but did not change the location or size of the "Wild Horse Management Area." That agreement also called for the joint development and implementation of a management plan that included an annual inventory of horse and burro populations, a continuing review of their habitats, and the determination of necessary management/facilitation projects. The Five-Party Cooperative Agreement, signed in 1977, assigned the BLM the responsibility of conducting an annual census and determining the condition of vegetative resources, but did not otherwise modify the previous 1974 agreement.

The northern and part of the eastern boundaries of the NWHR are fenced where they correspond with the boundary fence of the NTTR. The remaining boundaries are unfenced, resulting in an unconfined management unit.

3.6.8.2 **Establishment of Wild Horse Herd Areas**

One requirement of the WHBA is to define the Herd Area and Herd Management Area, for all horse herds that existed in 1971. The federal regulations that implement the WHBA, define a herd area as the geographic area used by a herd as its habitat in 1971. This has never been accomplished on the NTTR (Keystone Center, 1998; BLM, 1992). The first aerial census of horses on the NTTR was taken in 1977 and counted 1,300 horses on the NWHR and adjacent withdrawn lands. Earlier horse censuses were all from the ground. The 1980 aerial census counted 3,122 horses on the NTTR. A Wild Horse Herd Management Area Plan was finally prepared and approved by the BLM, USAF,

DOE, USFWS and NDOW in 1985. Three home ranges were identified (Kawich, Stonewall, and Goldfield Hills) and it was estimated that 4,000 to 5,000 horses were utilizing approximately 1,165,000 acres. While the 1985 plan proposed managing the horses where they were found in 1971, it also called for reducing the number of horses to 1,000 on the Kawich Home Range and removing all animals from the Stonewall and Goldfield ranges. An AML of 2,000 horses was also proposed. It also proposed maintaining and/or improving existing water sources.

Herd management areas can be all or only part of a herd area, but cannot exist outside the identified herd area. The 1992 Approved Nellis Air Force Range Resource Plan (NAFRRP) and Record of Decision (BLM, 1992) identifies the NWHR as the herd management area for the NTTR Herd. Also, the 1992 approved management plan identifies the 1971 herd area as an area that is largely non-coincident with the NWHR (i.e., the herd management area: see Map 5 on Page 8 of the 1992 document). The draft 1992 NAFRRP which was sent out for public review and comment, contained a map of the 1971 herd use area that encompassed most of the NTTR North Range. The 1992 approved plan designations are inconsistent with the federal regulations adopted to implement the Wild Horse and Burro Act.

There are no known census or location data from 1971 that can be used to accurately and definitively define the 1971 herd use area in the planning area. The BLM and the Nevada Wild Horse Commission have a variety of qualitative and quantitative data about wild horse numbers, and/or locations from throughout the 1970s and early 1980s that can be used to identify the approximate area wild horses used in 1971. Figure 3-11 delineates the approximate wild horse use areas in 1971, as depicted by the BLM's State Wild Horse and Burro specialist. His sources for the data, however, are unknown. Figure 3-12 shows actual count data obtained from between 1972 and 1974. The count (point) data are from ground surveys. Wild horses were widespread from the west slope of the Belted Range across Kawich Valley into Cactus and Gold flats. Most sightings were on the eastern side of Cactus Flat, with fewer in Gold Flat and near Mud Lake. The absence of count data from the Cactus Range, Stonewall Flat, Stonewall Mountain, and Pahute Mesa areas cannot be used to definitively conclude that horses were absent from those areas. None of the original maps from which the count data were obtained were accompanied by meta data about which areas were, and were not, surveyed. Areas on Figure 3-12 that indicate an absence of horses, may indicate "no horses" simply because the areas were never visited. Data provided by the Nevada Division of Wildlife (see the table on Figure 3-12) support this possibility. Their biologists identified three large bands of horses near Cactus Peak and Stonewall Mountain, while conducting censuses for antelope. The elevation and physiographic identifiers (i.e., valley bottoms) suggest these bands were located on alluvial landforms below the mountains, but above the low point of Stonewall Flat.

Information on file with the Nevada State Wild Horse Commission suggests that wild horses probably used much of the northern planning area in 1971. Until the late 1970s, potentially 6,000 to 8,000 or more cattle may have grazed on portions of the northern planning area. A similar number of total ungulates occurred in the late 1980s and early 1990s when wild horse numbers reached as high as 10,000 (cattle were absent). When horses numbered about 10,000 animals they were observed over the entire north planning area from Kawich Valley to Stonewall Mountain, and from Pahute Mesa to the northern boundary. The large number of cattle and horses in 1971 is likely to have resulted in one or both species having to range across most of the northern planning area, to meet their forage demands, since both species primarily consume grasses (Hanley and Hanley, 1982; Krysl et al, 1984). Horses are much more mobile than cattle. The availability of forage and seasonal water at the south end of Gold Flat, the northern rim of Pahute Mesa, Tolicha Peak, and northward to Stonewall Mountain (personal communication, Gary McFadden, BLM wild horse specialist), combined with high grazing pressures in 1971, most likely would have resulted in wild horses using much of the northern planning area, from Kawich Valley to the western boundary. In July 1997, after numerous gathers, there were a total of 526 horses on the NTTR, with a sex ratio of 1 stallion to 3

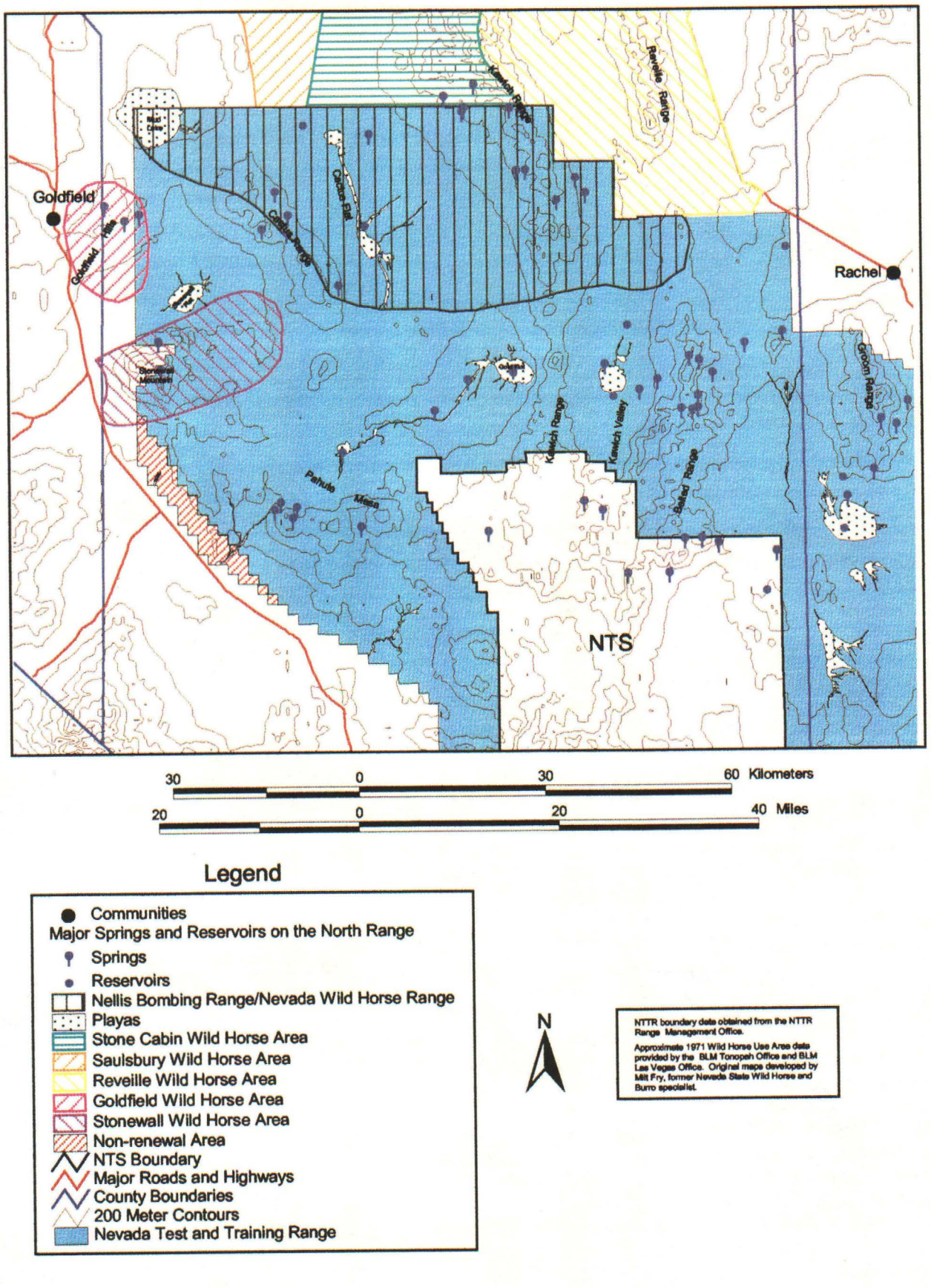


Figure 3-11. Approximate 1971 wild horse areas.

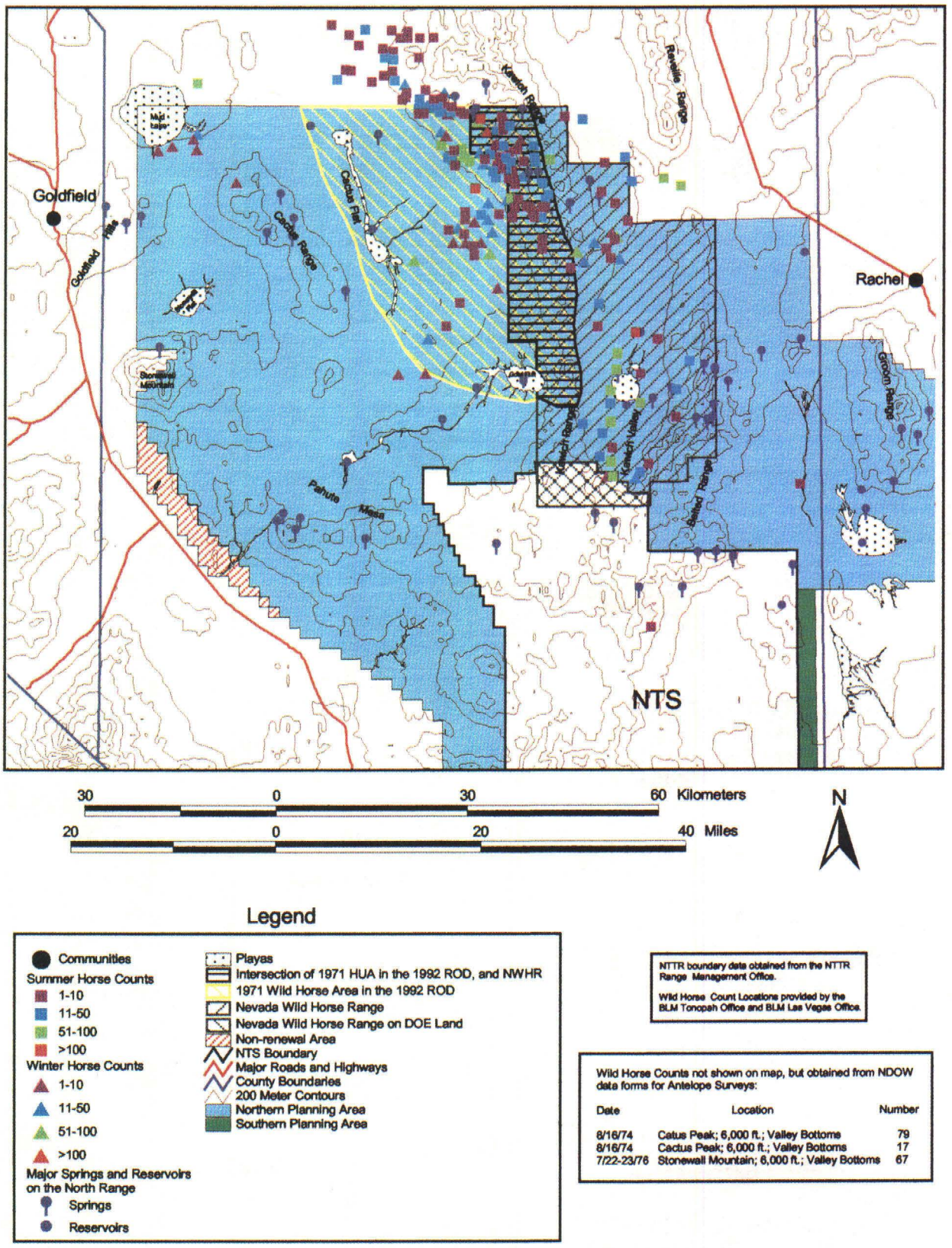


Figure 3-12. Point data for counts of wild horses in the planning area, between 1972 and 1974. Point counts are by ground surveys.

mares (data from Gary McFadden). The annual removal of horses and burros from NTTR is summarized in Table 3-9.

The 1980 burro population was estimated at 69 individuals and increased to a maximum of 195 individuals in 1982. Removals decreased the population to four burros in 1987 (USAF, 1997a). Ten to 12 burros were observed on the northern planning area during the April 1997 aerial surveys (personal communication, McFadden, 1997).

Wild horses, historically, have concentrated their activities around water sources. When populations have been high (i.e., in the thousands), the upland vegetation has been heavily grazed for 8 to 10 miles from accessible water (USAF, 1997a). Forage utilization appears highest where plant communities contain a high percentage of palatable species. The NTTR Wetlands Survey Report (Dames and Moore, 1996) describes wild horses as the source of degradation at springs and seeps on the NTTR. The Air Force has constructed exclosures around some seeps and springs located outside the current Wild Horse Management Area to eliminate all grazing of the riparian area by horses. The intent is to allow the riparian vegetation to fully express itself and improve habitat for other types of wildlife. This effort did not include piping any water to locations outside the exclosures, so that the horses still have a water source.

Table 3-9. Annual Wild Horse and Burro Removals from NTTR, 1985-2000

Date of Removal	Location of Gather	Animals Removed
Jun 1985	Cactus Flat	1,498
Jun 1988	Cactus Flat	1,043
Jul/Aug 1987	Cactus Flat	1,210
Dec 1989	Cactus Flat	683
May/Aug 1991	Cactus Flat	2,269[a]
Jan/Feb 1992	Kawich Valley	820
May/Jun 1992	Cactus Flat	730
Jan 1993	Stonewall Flat, Gold Flat & Cactus Flat	563
Sep 1993	Stonewall Flat, Kawich Vly, Gold Flat & Cactus Flat	872[b]
Dec 1994	Stonewall Flat, Gold Flat & Cactus Flat	743
Jul 1995	Kawich Vly, Stonewall Flat, Gold Flat & Cactus Flat	1075
Jul 1996	Kawich Valley, Stonewall Flat & Cactus Flat	556
Jan 1997	Kawich Valley, Cactus Flat	429
Jun 1997	Kawich Valley, Cactus Flat	543
Aug 2000	Kawich Valley	150
Total Removal - 1985-2000		13,184

(a) the 1991 removal included 395 orphaned foals
(b) the 1993 removal included 126 burros and mules

3.6.8.3 **Seasonal Wild Horse Herd Movements**

The BLM Las Vegas Field Office wild horse and burro specialist believes that three largely independent herds exist on the NTTR. One is located in Kawich Valley, a second largely in Cactus Flat, and a third in the vicinity of Stonewall Flat and Mud Lake. Each herd roams in a north-south direction, largely within the confines of their respective valleys. Each herd summers near perennial springs, which are largely located toward the north end of each valley. Most horses move south when ephemeral water sources from rain or snow are available. Movement between herds is uncommon,

particularly between the Kawich herd and the Cactus Flat herd. The Cactus Flat herd and the Stonewall herd periodically mingle near Mud Lake and near Tolicha Peak. This interaction appears most common during wet winters, when abundant ephemeral water sources permit the Cactus Flat herd to move across large expanses without perennial water supplies.

Stonewall Flat Herd

Historically: There were resident bands using Stonewall, Wild Horse, Sleeping Column, and additional springs on the east side of the Cactus Range. A large number of horses also used the pit reservoirs in Mud Lake and playa south of the TTR Man Camp. Following rain events most of these horses would move to the Stonewall playa to use feed that was unaccessible due to the absence of perennial water sources. During winter months the horses moved south to this area, and to the area west of Mt. Helen to utilize forage, and use water from snowmelt and/or ephemeral reservoirs.

Currently: Most of the water has been fenced by the Air Force and the BLM has removed most of the resident horses. Horses still present follow the same historic movement pattern, with the exception of access to the fenced waters. This migration from summer to winter ranges still exists despite adequate feed for the smaller population. There is still some movement of horses between Stonewall Flat and Cactus Flat.

Cactus Flat Herd

Historically: Most perennial water sources are located in the northern third of the valley. This area comprises the horses' summer range. During the summer, almost all of the horses in the Cactus Flat herd congregated on the piedmont fan north of the Cedar Pass Road, but below the Kawich Range. Following significant summer rain events, almost all horses moved south to use water that accumulates in pit reservoir areas in the playas located in the southern portion of the valley on both on the numbered ranges on Gold Flat and the southern portion of NTTR ranges EC east and west. Horses remained until the water supply was exhausted. Following sufficient winter snowfall, horses migrated south to use snow and/or water in the reservoirs. Most of the animals would remain on Gold Flat (NTTR ranges 75 and 76) all winter and early spring until the stored water was exhausted. The horses then moved back onto their summer range (northern third of valley). To facilitate movement from Cactus Flat (summer range) to Gold Flat (winter range), the BLM constructed two pit reservoirs located mid-way between springs and reservoirs toward the north end of Cactus Flat. Ample winter forage exists near Pahute Mesa and Tolicha Peak.

Currently: The same synopsis exists today.

Kawich Herd

Historic and Current: Most perennial water in this valley exists is in the northwest corner. Like the Cactus Flat herd, the horses use the northern third of the valley as summer range. During any summer rain event, most, if not all, horses move south to the Kawich Valley playa. Once winter arrives (November-December), all animals move to the south end of the valley to their winter range, utilizing snowmelt and/or water stored in reservoirs. Almost all animals remain there until the playas dry up (May-June). They then move north to Cedar Well, Cedar Spring, and Sumner Spring and remain on this summer range until winter arrives or summer rainfall events occur.

3.7 CULTURAL AND HISTORICAL RESOURCES

3.7.1 OVERVIEW

Over 2,500 cultural resources have been identified on the NTTR during surveys to comply with sections 106 and 110 of the *National Historic Preservation Act* (16 U.S.C. 470h-2). Approximately 140 of these resources are eligible for nomination to the National Register of Historic Places. Knowledge about the historic contexts of these resources has not been fully synthesized since 1979 (Bergin et al., 1979). The Nellis AFB Cultural Resources Management Plan (USAF, 1998) was prepared to describe a five-year program focused at sample surveys. Many of those surveys have

been conducted. The Air Force also initiated a Native American Interaction Program, seeking input from American Indians about NTTR resources that may hold special religious values. The known cultural resources on the range may be organized into five broad categories: American Indians, historic mining activities, ranching and farming activities, historic transportation and communication patterns, military use of the area.

3.7.2 AMERICAN INDIANS

American Indians used the area on and near the NTTR from about 12,000 years ago until it was withdrawn as the Las Vegas Bombing and Gunnery Range in 1940. The earliest cultural remains belong to inhabitants with spear points comparable to the Clovis hunters of the Great Plains. Recorded resources represent all subsequent periods, and occupation appears to have been continuous. Aboriginal structures on Pahute Mesa have been dated (with tree rings) to as late as A.D. 1947. American Indians claim they used the area well into the 1950s. Although, early explorers noted that several of the region's Indian groups practiced limited forms of agriculture at the time of contact, most researchers feel that the primary mode of subsistence was hunting and gathering. Knowledge about how these groups exploited the available resources may reveal important information about hunter and gatherer adaptations to highly variable environments, and the processes (evolutionary and non-evolutionary) of cultural change. For example, the earliest cultural resources on the NTTR (12,000 to 8,000 years bp) tend to be located around pluvial lake beach terraces in Emigrant Valley (Groom Lake), southern Ralston Valley (Mud Lake), Kawich Valley (Lake Kawich) and Gold Flat (Gold Flat Lake), and in the marshy lowland settings of Indian Springs Valley and the south end of Three Lakes Valley. Few early sites have been found at higher elevations, and it was not until about 8,000 years ago that hunters and gatherers began to exploit upland resources. By the end of the mid-Holocene period (5,000 to 1,500 years bp), resources located in the lowlands had become much less desirable; most cultural resources are found in the uplands, particularly those areas supporting PJ woodlands. A shift in emphasis from resources obtained through hunting to resources procured through gathering, as well as a change in mobility patterns, appears to be concomitant with this shift in the emphasis in zones of resource exploitation. The cultural resources in the planning area may help archaeologists understand why, when, and how these subtle changes occurred.

American Indian resources in the planning area also include archaeological remains about cultural enterprises other than subsistence activities. Rock art (pictographs and petroglyphs) is widespread throughout the planning area. These sites embody the symbolic (cognitive) aspects of past inhabitants, and may be important for more than only their research value. Rock alignments, power rocks, trail markers, habitation structures and other architectural features also have been recorded. Likewise, American Indian consultants have identified areas and sites that may hold special religious and sacred values. The volcanic and carbonate bedrock provided a wide variety of quarried stone that was used in the lithic technologies developed by Indian inhabitants. Trace element studies indicate that some of this toolstone appears to have been traded to outside groups. Finally, numerous American Indian sites on the NTTR contain artifacts (e.g., particularly pottery, pipes and beads) that may help archaeologists understand other prehistoric trade networks.

3.7.3 MINING ACTIVITY AND DEVELOPMENT

Euro-American settlers were initially attracted to the region for its mineral resources, beginning in the second half of the 19th Century. The earliest mining activities occurred in the Reveille, Groom and Southeastern mining districts. Little has been recorded about activities during the early Comstock Era (1849 - 1880), and who radiated out from nearby mining centers in Austin, Ione, San Antonio, Tem Piute, Pahranagat, and other towns. Mineral resources were extracted most intensively during the Tonopah Era (1900- 1920), with short-lived mining camps established at Gold Crater, O'Briens Camp (Wellington), Wilsons Camp, Trappman's Camp, Sulphide, Blake's Camp, Cactus Spring, Gold Reed, Oak Springs, Jamestown, and Wheaton. After 1920, mining activities continued only in the larger and more productive mining districts. During the Great Depression, mining on the NTTR increased when many unemployed workers left nearby towns to work formerly

abandoned mining camps. Many small mines on the NTTR were still being worked when the planning area was withdrawn for military use in 1940.

3.7.4 FARMING AND RANCHING ACTIVITIES

Farming and ranching history in southern Nevada is closely linked with the mining history. Boom towns provided the initial inducement for immigration and the markets for products. Three periods of farming and ranching occurred on the NTTR: Comstock Era ranching (1860-1900), Stewart/Reed Era ranching (1900-1940), and contemporary ranching (1940-present).

The Air Force allowed permitted livestock grazing on the NTTR until 1956, when permits were purchased. Base properties (headquarters) were not located on the NTTR, but ranching features on the NTTR include line shacks, seasonal ranch houses, corrals, fences, ditches, earthen and concrete stock tanks, water tanks, pipe lines, trails and other livestock management features. These resources may have the potential to provide valuable information about the nature, extent, timing, and/or differentiation of ranching activities in the planning area (and southern Nevada). Also, the remaining artifacts exemplify the character and significant roles of prominent individuals who developed the ranching and settlement history of Nevada (W. T. Stewart, Sr., O. K. Reed, J. W. Adams, etc.). Finally, the remaining ranching artifacts may characterize important aspects of, and changes in, ranching methods and technology.

3.7.5 TRANSPORTATION AND COMMUNICATION DEVELOPMENT

The NTTR is not located on well-known overland routes (e.g., the Old Spanish Trail, Humboldt Trail); however, the routes taken by several famous early explorers and emigrants crossed the NTTR. These include John C. Frémont, the Death Valley 49ers, C. Hart Merriam's Death Valley Expedition, George Wheeler's geographical surveys, and Governor Blasdel's visit to the newly acquired state lands near the Pahranagat mines. With the passage of time, changes occurred in the nodes that connected the transportation and communication routes through the NTTR. The methods of travel and cargo also changed. The main centers of supply and export during the early Comstock Era were to the north and east, and travel was by horse and wagon. During the Tonopah Era, important supply and export nodes shifted to railroad sidings located south and west of the NTTR. By 1913, the automobile was replacing the horse and wagon. These important shifts in transportation technology appear to have influenced cultural development and cultural resources throughout the planning area. Inhabitants established new roads and new alignments, and also changed the types of items deposited along them.

3.7.6 MILITARY ACTIVITIES

In 1940, President Roosevelt issued an Executive Order establishing the Las Vegas Bombing and Gunnery Range on about 4 million acres, between Tonopah and Las Vegas. The Air Corps Gunnery School was officially established on June 11, 1941. After World War II ended, the airfield was closed and converted to caretaker status. The Air Base in Las Vegas was reopened in 1948. Advances in aircraft technology (F-80 series jets) required a greater emphasis on research and experimentation, and standardization of tactics and training methods. To meet these needs, the Air Force's Aircraft Gunnery School was established at the Las Vegas Air Force Base in May 1949. The school's mission was to train instructors in all phases of fighter gunnery, rocketry and dive bombing, and to develop training methods on all related equipment. The mission also included a test, research, and development branch. The infrastructure associated with the Army Air Corps' early use of the NTTR produced a cultural landscape that is unique to that period's military mission. After WWII, several changes in military mission have changed the pattern and distribution of the military-related cultural resources in the planning area, and produced a continuously changing cultural landscape.

The Atomic Energy Commission (AEC) also conducted nuclear activities on the NTTR. Most activities were located on the Nevada Proving Ground, a part of the Las Vegas-Tonopah Gunnery Range withdrawn by the AEC. Three non-nuclear safety shots were conducted in the planning area

between 1954 and 1963 to determine the behavior of nuclear weapons in conventional accidents, and the biological uptake of plutonium by plants and animals located downwind from release points. Underground nuclear testing after 1962 resulted in research about the movement of contaminants to aquifers beneath the Nevada Test Site and adjacent areas. The AEC drilled several hydrologic test holes on the NTTR. Geologic exploratory holes were also constructed at the north end of the Halfpint Range east of Groom Pass.

3.8 LAND STATUS, DESIGNATIONS AND USES

3.8.1 ACCESS

The NTTR is withdrawn for use by the Secretary of the Air Force as an armament and high hazard testing area, training for aerial gunnery, rocketry, electronic warfare and tactical maneuvering and air support, equipment and tactics development and testing, and other defense related activities.

As a consequence, the entire planning area has restricted access for safety and security reasons. Entry is permitted only for individuals with appropriate clearances, and a need to be on the NTTR. Many specific locations have additional restrictions. Access clearances granted to land managers from the BLM and other agencies cover only part, not all, of the planning area. When land mangers have the appropriate access clearances, they may not have access at all times. Training and testing missions often close parts of the NTTR for extended periods (weeks to months). This potentially eliminates access during temporal periods when resource specialists should collect discipline-specific information and data, or must respond to emerging management issues (e.g., stressed wild horses).

These public safety and security issues also restrict access and land use for local governments and communities, preventing use of a suite of natural resources on the NTTR for community and economic development. These resources include, but may not be limited to, unappropriated water resources, minerals and industrial commodities, woodland products, livestock forage, and recreational opportunities (e.g., hunting, rock hounding).

3.8.2 LANDS PROGRAM

The Air Force has proposed to relinquish one parcel near Indian Springs (approximately 3,056 acres) to the BLM. This rectangular "finger" has an approximate shape of 0.5 miles x 10 miles, which presents an impossible management situation.

The Air Force has not filed for renewal on approximately 33,000 acres (in one parcel) along the western boundary of the NTTR, between Tolicha Peak and Stonewall Mountain. This area will be returned to the BLM, provided environmental contaminants and/or other human-made hazards are absent.

There are no other land relinquishments being contemplated at this time.

3.8.3 NATURAL AREAS AND AREAS OF CRITICAL ENVIRONMENTAL CONCERN

The Timber Mountain Caldera is the only designated ACEC on the NTTR. This geologic feature covers several hundred thousand acres across both the NTTR and the NTS. There are no active targets or industrial complexes within the confines of the caldera, and it is traversed by few roads.

3.8.4 RECREATION

Recreation, with one exception, is not permitted in the planning area, due to safety and security constraints. The exception is hunting for bighorn sheep, in the North planning area, at Stonewall Mountain (see Figure 1-1). Hunting on Stonewall Mountain is a mitigation measure agreed to by the Air Force as partial compensation for the 1986 Groom Mountain Range land withdrawal. An MOU between the Air Force and the State of Nevada guides the management of

bighorn sheep on Stonewall Mountain, including permitted hunting activities. Hunting currently occurs for a three-week period from late November through early December. Stonewall Mountain is within hunting unit 252, and in the year 2000 had a quota of two bighorn sheep. The sheep hunts on the South Range occur on the DNWR, and thus are outside the planning area.

Executive Order 11644 (5/24/77) requires that the BLM complete designations for off-road vehicle use on all public lands. Off-road vehicle designations are not applicable to the planning area because E.O. 11644 specifically exempts withdrawn "lands under the custody and control of the Secretary of Defense" (Sec. 2(1)(C)) from the definition of public lands. The authority to designate lands on the NTTR as accessible to off-road vehicles resides with the Secretary of Defense.

3.8.5 WILDERNESS DESIGNATIONS

Congress passed the Federal Land Policy and Management Act (FLPMA) in 1976 (PL 94-579). Section 603(c) of the act requires that the BLM conduct inventories/evaluations on public lands under its jurisdiction to determine roadless areas and islands which may have wilderness characteristics.. An evaluation of the NTTR was performed in 1978 by BLM in coordination with representatives of the Sierra Club, Nevada Outdoor Recreation Association, University of Nevada, Reno, Recreation Department, and Friends of Nevada Wilderness. (BLM, 1981). The lands encompassed by the Groom Mountain Range addition to NTTR were inventoried during the BLM statewide inventory conducted in 1979.

Also, the NAFRRP (BLM ,1992) evaluated 2.2 million acres of NTTR withdrawn land, the lands that are not part of DNWR, for wilderness characteristics. As a part of that study, the BLM determined that none of the lands considered met the minimum criteria for wilderness study area (WSA) designation. Most of the planning area is directly or indirectly influenced by an extensive network of linear corridors and disturbed area nodes (see Figure 3-1).

Based on these inventories/evaluations, the BLM determined that the planning area did not contain any land that met the minimum criteria for consideration as a wilderness study area. Wilderness designation is intended to preserve areas in an undeveloped state with little evidence of human activity. Subject to certain exemptions, use of motor vehicles or other motorized equipment, landing of aircraft, and construction of structures and roads are prohibited in wilderness areas. Solitude is one of the criteria for wilderness designation.

3.9 **WASTE AND HAZARDOUS MATERIALS MANAGEMENT**

3.9.1 HAZARDOUS MATERIALS MANAGEMENT

Hazardous materials are defined as any substance that, due to quantity, concentration, physical, chemical, or infectious characteristic, may present substantial danger to public health, welfare, or the environment when released. Examples of hazardous materials on the NTTR include petroleum, natural gas, synthetic gas, toxic chemicals, and low-level radioactive sources, such as compasses and gauges.

Focal points for hazardous materials on the NTTR are the industrial complexes located at the Tonopah Test Range, the Tonopah Operation and Management (O&M) Compound, the Tolicha Peak Electronic Combat Range (TPECR), the Cedar Pass Facility, Indian Springs Air Force Auxiliary Air Field (ISAFAF), Point Bravo, and Silver Flag Alpha. Among other points of concern are hard targets, electronic warfare sites, power substations, and roads on which hazardous materials are transported.

3.9.2 HAZARDOUS WASTE MANAGEMENT

Activities that generate hazardous wastes at some or all of the NTTR industrial sites are fuel handling and storage, vehicle maintenance and cleaning, aircraft maintenance and cleaning, fire training, landing operations, civil engineering infrastructure maintenance, and construction. The Air

Force and its range contractors store and use moderate amounts of paints, solvents, thinners, adhesives, aircraft fuel, diesel, gasoline, lubrication oils, brake and hydraulic fluids, cleaners, batteries, acids, chlorofluorocarbon refrigerants, herbicides, insecticides, rodenticides, and compressed gases in compliance with applicable regulations and Air Force instructions.

Solid and hazardous wastes are generated at both manned and unmanned sites. Waste sites include target debris staging areas, exploded ordnance disposal sites, practice and live ordnance ranges, and electronic countermeasure (ECM) sites.

The Air Force manages several, 90-Day Accumulation Points, including those located at Point Bravo, Indian Springs Air Force Auxiliary Field (ISAFAF), Tolicha Peak Electric Combat Range (TPECR), and Tonopah Test Range (TTR) Area 10. Hazardous waste is picked up in place by appropriate vendors. Eighty-three ECM sites were visually inspected on the North Range in preparation of the 1999 withdrawal of the NTTR (USAF, 1999). Possible fuel releases were identified at 30 sites, and generally ranged up to several feet in diameter.

The majority of the non-weapon hazardous materials used by the Air Force and its contractors are controlled through an Air Force pollution prevention process called HAZMART. HAZMART provides management for the procurement, handling, storage, and issuing of hazardous materials and their turn-in, recovery, reuse, recycling, and/or disposal.

3.9.3 ELECTRONIC WARFARE SITES/TARGETS

Electronic warfare sites typically consist of a small graded area (20-250 ft diameter) with either manned or unmanned mobile radar stations, and related support equipment. Typical support equipment includes 250- to 600-gallon portable fuel (diesel or aviation) tanks and their associated generator(s). The sites generally have a scraped soil surface, covered with 2 to 6 inches of compacted fine- to medium-grained soil and gravel.

The use of live and practice ordnance on the NTTR generates a large volume of target debris, smaller quantities of exploded ordnance debris, ordnance casings, concrete, live ordnance, and trace amounts of explosive residue. A surface soil sampling program conducted at six bombing targets on the North Range found concentrations of inorganic and explosive constituents above background concentrations. Semi-volatile organic compounds (SVOCs) and polynuclear aromatic hydrocarbons (PAHs) were generally absent from target areas. The inorganic concentrations were generally less than the USEPA Preliminary Remediation Goals (PRGs), but certain explosives frequently exceeded the risk-based PRGs (Air Force, 1996b).

The primary inorganic constituents detected on the range were cadmium, chromium, copper, nickel, zinc, cyanide, and to a lesser degree lead. Each is likely a result of expended ordnance, although all are natural soil constituents that typically occur at low concentrations. Also present are antimony and mercury; however, their concentrations are generally very low. The inorganic PRGs for the above-listed inorganic parameters were only exceeded once for chromium (USAF, 1999).

The use of cluster bomb units (CBUs) results in the highest and most widespread distribution of both inorganic and explosive contamination among the target sites sampled. The use of HEI ammunition also appears to cause relatively high and widespread contamination, particularly with respect to explosives contamination. The soil contamination concentrations relative to the USEPA Preliminary Remedial Goals, for both the CBU and HEI sites, are usually within 600 feet of the immediate target area. There is one target in the planning area where live CBUs are authorized (75-46) and two targets where HEI is authorized (71-12, and 74-4 on the North Range) (personal communication, Starrett, 1997, as cited in USAF, 1999).

The Air Force has considered ecological risks at targets located on playas to be insignificant because the playas are naturally free of vegetation (USAF, 1999). This conclusion may be inaccurate. Playas are terminal points for overland flow. Contaminants that occur at low concentrations on large upland watersheds (i.e., source areas) can become concentrated on comparatively small playas (i.e., sinks). Contaminants carried to playas can potentially be re-suspended during flood events, or wind storms when playa surfaces are dry. Wildlife that consume water or food (e.g., brine shrimp, algae) can potentially become contaminated.

The remaining live ordnance types, such as air-to-ground missiles, rockets, general purpose bombs and guided bomb units, result in some localized areas having concentrations of metals and explosives above background levels but these target areas seldom exceeded the risk-based PRGs. The types of contaminants were similar to those previously discussed. These general ordnance types account for the majority (about two-thirds) of the target area. Two NNSA (DOE) industrial sites of significant area on the TTR are the Bomblet Target Area and NEDS Lake. NEDS Lake is located within the Bomblet Target Area. The NEDS lake area is contaminated with depleted uranium and the Bomblet Target Area is contaminated with conventional ordnance. Site investigations have been initiated because the areas are active weapons test areas and may contain live ordnance. The NEDS Lake and Bomblet Target Area are listed as inactive sites, pending characterization and corrective actions.

3.9.4 RADIOACTIVE CONTAMINATION

Tests of nuclear devices conducted in Nevada by the U.S. have caused radioactive contamination of the land surface and groundwater. Although most tests were conducted on the NTS, some caused contamination of the surface and/or groundwater on the NTTR. Several tests conducted on the NTTR have left areas of surface contamination. Nuclear weapons that were exploded on or above the surface left downwind surface contaminants; some of these are in the southern planning area (DOE, 1996). Some nuclear weapons that were exploded underground contaminated groundwater that may have moved beyond the boundaries of the NTS.

3.9.5 SOLID WASTE MANAGEMENT

In the north planning area, nonhazardous refuse, office wastes, dining hall wastes, construction debris and garbage that are generated in the major operating areas are collected in dumpsters and transported to permitted landfills. Hazardous waste, asbestos waste, and other special wastes are not permitted in these landfills. In the south planning area, nonhazardous refuse and garbage generated in the major operating areas are picked up by a commercial disposal company and transported off-range to the Apex disposal site north of Las Vegas for disposal. Materials containing asbestos are removed from the range by licensed contractors and transported to commercially licensed, permitted disposal facilities off-range. Polychlorinated biphenyl (PCB) contaminated equipment and wastes are disposed of through the DRMO. They are transported off range and disposed of at licensed facilities. Hazardous wastes are removed from the range by licensed contractors and transported to commercially licensed and permitted disposal facilities off-range (personal communications, Vanderveen and Feldt, 1997, as cited in USAF, 1999).

3.10 **SOCIOECONOMICS**

The NTTR socioeconomic region of influence includes Nye County, Lincoln County and Clark County, Nevada. The majority of the State of Nevada's population resides in Clark County, in the Las Vegas Valley. The largest community in Nye County (the largest county in the United States) is in Pahrump Valley (approximately 30,000 people). It is a bedroom community for the Las Vegas metropolitan area. The largest community in Lincoln County has less than 3,000 people. Thus, the three surrounding counties are quite disparate.

A full, detailed, description of the economies of Clark, Lincoln, and Nye counties is presented in the Legislative Environmental Impact Statement prepared for Renewal of the Nellis Air

Force Range Land Withdrawal, Department of the Air Force, March, 1999. That document addressed and analyzed the social and economic impacts attendant to the continuation of the land withdrawal for use as a national test and training facility.

This analysis focuses upon the potential social and economic effects that might result from proposals for management of the existing resources on those withdrawn lands. No social or economic impacts, beneficial or adverse, have been identified, nor are any expected. Further discussion of this analysis may be found in Section 4.10.

CHAPTER 4
ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE ACTIONS

4.1 INTRODUCTION

Four alterative actions are analyzed for potential effects. Alternative A is the No-Action alternative. Alternative A would manage the NTTR as outlined in the 1992 Nellis Air Force Range Resource Plan and Record of Decision (BLM, 1992) and include several changes made as a result of the 1992 Plan's management objectives. Alternatives B, C, and D focus on different alternatives for managing wild horses in the planning area.

4.1.1 SUMMARY OF ALTERNATIVES, ISSUES AND OBJECTIVES

4.1.1.1 **Alternative A**

The No Action alternative is basically a reprint of the approved 1992 Nellis Air Force Range Resource Plan and Record of Decision. This description identifies what objectives, management directions and management actions of the existing Resource Plan have or have not been implemented. No new management objectives are proposed in this alternative.

4.1.1.2 **Alternative B**

Alternative B is the preferred alternative (Figure 2-3). Most of the northern planning area is identified as both the proposed wild horse herd area and the herd management area. A smaller area is identified as the area on which available water and forage would be quantified and used to determine the appropriate management level (population size) of the wild horse herd. The herd area (HA) represents the area that the BLM believes wild horses used in 1971. Establishing a herd area that identifies the area that wild horses used in 1971 is a legal requirement of the 1971 Wild Horse and Burro Act. The Las Vegas Field Office does not believe an appropriate herd area was previously established. The BLM has proposed that resources from a much smaller area within the HA/HMA be used to determine the appropriate management level (AML). The proposed area for AML determination represents that part of the planning area on which horses concentrate their use during the spring and summer months. This is the period of active plant growth, when plants are most sensitive to excessive levels of defoliation, and minimum water availability. The proposed area for AML determination also represents the area with the fewest access restrictions. It contains no active bombing ranges, has an abundance of roads, and seldom has large areas closed for more than a few hours or days at a time.

4.1.1.3 **Alternative C**

Alternative C identifies the same herd area as Alternative B, but proposes a much smaller herd management area (Figure 2-4). The herd AML would be calculated based on the forage and water resources within the herd management area. The HMA's boundaries largely coincide with the area in Alternative B used to determine the appropriate management level of the horse herd. The primary difference is that the western boundary has been moved from the crest of the Cactus Range toward the center of Cactus Flat.

4.1.1.4 **Alternative D**

Alternative D (Figure 2-5) would eliminate the wild horse herd from the planning area. To meet the regulations that implement the Wild Horse and Burro Act, Alternative D defines the area that wild horses used in 1971 (i.e., the herd area). All horses would be removed, and the planning area would remain free of horses and burros.

4.1.2 EVALUATION OF ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVES

Alternatives A and B are discussed for each resource addressed below. Alternatives B, C and D are very similar for the majority of the resources, except for management of wild horses. The following analysis focuses on the difference in impacts for each alternative. Where the impacts are the same for each alternative, that will be stated as appropriate.

The impacts to each specific resource are identified under the resource category. For example, impacts to vegetation from grazing animals, military activities and other activities are stated in the vegetation section. This format is used for each resource category. Using this approach allows the reader to focus on their particular area/s of interest and what the expected impacts are to that resource.

A key point to consider during a review of this analysis is the programmatic nature of this document. Impacts are analyzed in a general manner primarily due the vast majority of the actions/activities which the BLM manages, are not dealt on a site specific basis. Site specific analysis will be undertaken during implementation of the objectives and management directions in the approved plan.

4.2 **PHYSIOGRAPHY AND CLIMATE**

4.2.1 PHYSIOGRAPHY AND TOPOGRAPHY

None of the alternatives are expected to significantly affect the planning area's physiography or topography.

4.2.2 CLIMATE

None of the alternatives are expected to significantly affect the planning area's climate.

4.2.3 VISUAL RESOURCES

Land disturbances are widespread and common throughout the planning area (see Figure 3-1). Most are located in the valley bottoms, or on lower foothills, and cover small areas. The mountainous areas and the Timber Mountain Caldera have very few man-made features, and none are large enough to dominate the viewscape. Natural landforms and features are visual dominants across the planning area. The Timber Mountain Caldera is the only area in the planning area classified as visually sensitive (Interim VRM Class II). The remainder of the planning area is in classes (or interim classes) III and IV. These visual classes are compatible with Air Force activities, and the extent of disturbed areas in the planning area.

4.2.3.1 **Alternative A**

The No-Action alternative will have no significant effects or consequences. The established VRM categories allow the Air Force to develop infrastructure in the planning area, to conduct its training and testing mission, without violating management guidelines. Changing the VRM classes to class II or class I would not be compatible with the Air Force's mission, or the extent of existing disturbances throughout much of the planning area.

4.2.3.2 **Alternatives B, C and D**

These alternatives are functionally identical to the No-Action alternative. The analysis for the No Action alternative is directly applicable to Alternatives B, C and D.

4.3 **AIR RESOURCES**

4.3.1 ALTERNATIVE A

Almost all of the planning area is outside of the Clark County non-attainment area. The EIS that analyzed the renewal of the withdrawal of the NTTR provided data that indicate Air Force training and testing programs do not significantly degrade air quality in or out of the non-attainment area (USAF 1999). The BLM conducts and/or authorizes substantially fewer activities in the planning area. The Bureau's most common function has been the census, roundup, and management of wild horses. Periodic fire suppression, riparian habitat inventories, and other infrequent activities also occur. The result of all activities within or adjacent to the non-attainment area would be minor releases of dust PM10 and other pollutants from vehicles. With any mitigation required from the CCHD, these releases would be reduced even further, upwards of 70% depending on the control efficiency of the required mitigation.

4.3.2 ALTERNATIVES B, C, AND D

Alternatives B, C, and D, focus their actions outside the Clark County non-attainment area. Implementation of any of these actions will not affect Air Quality in the non-attainment area.

For the remainder of the planning area, implementation of Alternatives B, C, or D will have effects similar to Alternative A. None of these alternatives affect the intensity or frequency of Air Force activities in the planning area. BLM actions associated with Alternatives B and C are expected to be more substantial than the No-Action alternative, but are limited in comparison to routine Air Force activities. Any additional pollutants emitted should be small and may not be measurable. None is expected to violate any local, state or federal law.

During any prescribed or natural fire there would be a temporary increase in PM10 and other pollutants associated with burning vegetation. For prescribed burns these pollutants would be quantified in the appropriate NEPA document and fire management plan. In addition all required permits would be obtained from the State and local agencies.

The military will continue to water and or gravel roads which will reduce PM10 emissions but not eliminate all releases. Any release is expected to be temporary and localized.

It is anticipated that minimal releases of PM10 during extraction of sand and gravel would occur. All CCHD regulations will be followed to reduce emissions.

Alternative D is likely to cause an unmeasurable decline in air pollutants, because the reduction in BLM activities would be limited to the eliminated management of wild horses and burros. The very small amount of pollutants added to the atmosphere by BLM activities result in no functional differences between any of the alternatives.

4.4 GEOLOGY, MINERAL RESOURCES AND SOILS

4.4.1 GEOLOGY

None of the alternatives are expected to significantly affect the planning area's geology.

4.4.2 MINERAL RESOURCES

The planning area contains a wide variety of mineral resources. Many resources have both a quantity and quality that could permit commercial extraction, for use outside the planning area. The entire planning area, however, was withdrawn from mineral exploration, pursuant to the P.L. 106-65 which withdrew the NTTR for military use. Commercial mining operations would interfere with the primary military training and testing mission, would present unacceptable health and safety concerns for non-military civilians, and would not conform to the military's security needs.

4.4.2.1 **Alternatives A, B, C and D**

Mineral extraction would remain limited to sand and gravel quarrying by the Air Force or its contractors to support the development of on-site infrastructure. Sand and gravel would be removed from more than five existing borrow pits, three new pits on previously disturbed sites, and from three sites in previously undisturbed areas (USAF, 1998). The area directly affected by these borrow pits is about 838 acres, including past and proposed quarrying activities (USAF, 1998). An Environmental Assessment concluded sand and gravel quarrying would have no significant adverse impacts (USAF, 1998).

The Air Force and BLM would continue to recognize patented mining claims in the Groom Range.

4.4.3 SOILS

Soils have not been mapped and there were no assessments conducted to determine locations that have high natural rates of erosion and deposition, or locations with accelerated erosion induced by human actions and management. Most soils at lower elevations are shallow, often poorly developed, and have low productive potential due to low rainfall. Locations in the mountains often have more productive soils.

Implementation of standard management practices should sustain the soil resource, reduce accelerated erosion, and identify areas where rangeland productivity could be enhanced, or at least maintained.

Alternatives B, C & D, provide broad direction to conduct soil inventories and assessments. To a large degree, the alternatives are not functionally different than the No-Action Alternative. The analysis of the environmental consequences are identical.

4.4.3.1 **Alternatives A, B, C, & D**

Air Force activities have had direct impacts on 3 percent or less of the planning area, but these actions have resulted in some contaminants being released. Contaminant levels generally are low, but could accumulate at down-gradient playas if flooding and erosion occur.

Many of the alluvial soils that dominate the fans and basins, and the fine-grained lacustrine soils on and near the playas are susceptible to high rates of wind erosion. The finer particles often become airborne, creating fugitive dust. This condition can be enhanced by human induced soil disturbance, and/or activities that reduce vegetation cover.

4.5 HYDROLOGY AND WATER RESOURCES

4.5.1 SURFACE WATER

None of the alternatives is expected to significantly affect the planning area's surface water.

4.5.2 GROUNDWATER

None of the alternatives is expected to cause any significant effects to the planning area's groundwater resources or aquifer systems.

4.5.3 WATER RESOURCES

Current Air Force and BLM operations in the planning area have little direct impact on surface water resources. Most are small springs or seeps located in the mountains, or at the base of the mountains, where few activities occur. Many springs and seeps, however, are affected by improper grazing from wild horses or cattle (Groom Range). These impacts include a reduction in water quality due to reduced vegetative cover around the spring sources. Permitted water rights are held on many, but not all, water sources.

Several, small fenced ponds (perennial) that support infrastructure development are located near industrial sites. Only avifauna and small mammals can use these. Reservoirs developed to support historic livestock grazing are widely scattered in valley locations, and provide water for a suite of wildlife species, including wild horses, following substantial precipitation events.

Groundwater withdrawal occurs in small amounts throughout the planning area. The amount withdrawn is much less than the estimated recharge to the NTTR regional aquifer systems.

4.5.3.1 **Alternatives A, B, C and D**

Recent water quality sampling indicates water standards are being met (Appendix C). The adoption/continuation of best management practices (BMPs) for grazing ungulates would reduce the potential for horses or cattle to introduce sediment, pathogen, and/or nitrogen contaminants into surface waters. Implementing BMPs would maintain or improve water quality.

Adoption or continuation of BMPs for erosion control at Air Force facilities (old and new) is not likely to benefit water quality at most springs and seeps, because the springs and seeps are located upgradient of the facilities. Ephemeral water sources may or may not have improved water quality. There are no baseline studies to determine if ephemeral waters are impaired, or if impaired, the source of the contaminants.

Filing for water rights on behalf of the BLM and/or the State of Nevada will ensure that water remains available for wild horses, wildlife, and livestock. Potential adverse effects from improper grazing can be mitigated by implementing appropriate management strategies and actions.

4.6 **BIOLOGICAL RESOURCES**

4.6.1 WILDLIFE

Air Force and BLM actions in the planning area have few direct adverse impacts on most, if not all, wildlife species in the planning area. Most activities are located in valley bottoms, where comparatively few wildlife species are present. The low density of most human features probably permits most, if not all, species to maintain populations near the planning area's peak production potential. Antelope have adapted well to the widely distributed electronic warfare sites, and will continue to use these areas as long as water provided for wild horses remains available for antelope. Bighorn sheep and mule deer are affected little by most human activities in the planning area. They use habitat in rugged areas that is seldom physically disturbed. Other species or species groups often benefit from human actions. These include bats and migratory waterfowl that use artificial water sources, and raptors and other avifauna that use utility lines for perching and nesting.

The most prominent threats to many wildlife species are: 1) competition with increasing horse populations; 2) the internal (density) and external (spatial area) expansion of PJ woodlands, and the associated loss of desired understory species (largely, shrubs and forbs); 3) increased threats of large catastrophic fires in dense PJ woodlands; 4) the expansion of cheatgrass in sagebrush rangelands, and lower elevation PJ woodlands; and 5) the possible invasion of riparian areas by invasive and/or noxious weeds. These processes, individually and collectively, can change the composition, structure, and function of large tracts of habitat, particularly in upper alluvial fans and mountainous areas. Mule deer, mountain lion, a large number of avifauna, and possibly fox are likely to be adversely affected.

4.6.1.1 **Alternatives A, B & C**

Alternative A should benefit wildlife populations and habitat, if fully implemented. This assumes that past constraints imposed by access restrictions in the Groom Range (and other areas) to inventory, assess and monitor wildlife habitat and populations are alleviated. If this administrative problem remains unsolved, implementation of Alternative A is unlikely to achieve the stated management direction and actions.

Implementation of Alternative B or C should benefit wildlife populations and their habitat, provided access constraints to the Groom Range and other areas are improved. Alternative B directs more attention to high profile species (e.g., bighorn sheep, antelope, sage grouse, raptors) and habitat types (riparian) than the No-Action alternative. This should better focus management efforts on issues with the highest importance.

Fencing spring sources will directly benefit wildlife by improving cover at the spring source, providing a protected area to drink a higher quality of water and potentially more abundant higher nutritious forage.

Mule deer are not expected to interact with horses, due to a differential use of habitat. Most deer use the mountainous terrain year-long. Horses concentrate their use in the valley bottoms. Incorporation of water and forage requirements for antelope into the AML determination should minimize adverse impacts on that species.

4.6.1.2 **Alternative D**

Removal of all wild horses would eliminate any potential competition with bighorn sheep, antelope, and mule deer. The extent to which these populations would increase, or if they would increase at all, is unknown. Relationships among these ungulates in the planning area are uncertain.

It has not been determined whether pipelines and water troughs established in northeastern Cactus flat would be maintained. Antelope, coyotes, and probably other wildlife use these water sources. For antelope, the water sources expand the area of suitable, year-long habitat. Removal of the horse herd may result in these artificial water supplies being abandoned, potentially reducing the amount of suitable habitat for antelope.

4.6.2 VEGETATION

Critical management issues related to vegetation include: 1) the internal (density) and external (spatial area) expansion of PJ woodlands; 2) the loss of understory species in closed canopy woodlands that are important to wildlife ; 3) increased potential for catastrophic fire in closed canopy woodlands; 4) the expansion of cheatgrass into burned woodlands that lack an understory of desired perennial species, and the subsequent loss of shrubs important to mule deer; 5) the lack of a perennial herbaceous understory (forbs and grasses) in lower elevation shrub sites, and the potential negative feedbacks to sage grouse (if present), desert tortoise, and antelope; 6) the expansion of invasive weeds along roads, communication corridors, and other anthropogenic disturbances, followed by slow but progressive movement into adjacent undisturbed areas; 7) the establishment of perennial noxious weeds that can eliminate large acreages of native flora, and change the structure and function of many landscapes; and 8) controlling the season, intensity, and frequency of grazing to allow for the reproduction of desired perennial species, and control of less desired species.

At the current population size (1,000 to 1,200), forage utilization by wild horses is not expected to be heavy or severe, except at select locations adjacent to water sources. At light to moderate forage utilization, plant vigor and production are expected to improve.

4.6.2.1 **Alternative A**

The No-Action alternative proposes to maintain existing species diversity and composition at existing ecological stages. Communities respond to fluctuating environments, thus, they are not static. They will change composition and diversity with time.

Many dense woodlands have lost most or all of their understory flora. This reduces their habitat value, often accelerates erosion, and creates conditions susceptible to catastrophic wildfire and the expansion of invasive and noxious weeds. Alternative A focuses on grazing levels (number of animals), but season of use and utilization levels are the primary factors that influence vegetation change. Reducing livestock numbers typically solves few problems if the seasons of use and utilization levels are improper. The No-Action alternative requires all revegetation efforts to use only native species. This management direction fails to recognize that in some situations non-native perennial species are often easier to establish, and they meet many habitat management goals. Failure to quickly establish a desired or acceptable plant community often results in invasive or noxious weeds becoming established, and limiting future management options.

Repeatedly grazed plants are stressed and have a limited capability to absorb soil moisture (i.e, expand roots, store carbon, and produce seed). Early spring grazing (March) is much less likely to cause problems, for a number of reasons. First, cattle should be coming off the Bald Mountain allotment, reducing the chance of repeat, severe defoliation. Second, soil moisture is typically high, allowing for full regrowth in April and May.

4.6.2.2 **Alternatives B, C and D**

These alternatives provide greater management flexibility to achieve desired plant communities, based on resource management objectives for a specific landscape. This approach is

likely to maximize potential benefits for other resources (e.g., riparian, wildlife, wild horses) in the planning area, including the closed canopy PJ woodlands. The ability to use either native or non-native species is likely to result in better success for reclamation/restoration efforts on disturbed sites, which should reduce the spread of invasive and/or noxious weeds. A focus on removing weeds should help maintain desired species composition, structure, and production in critical habitat areas, benefitting wildlife, livestock grazing, and water resources.

The response of upland herbaceous species in the AML determination unit is likely to be neutral to positive, depending on the specific location. Locations near water supplies will continue to be grazed at moderate to periodically heavy levels, with plants distant from water sources utilized less. Heavier use would be expected during drier years, when individual plant size is smaller, and each bite removes a proportionately larger amount of the current years growth. Assuming AML is set for water and forage production during dry years, the spatial extent of heavier utilization should be comparatively small, but probably cannot be avoided. The response of the herbaceous vegetation and palatable shrubs in the remainder of the HA/HMA is expected to be variable. If horses are largely eliminated from Kawich Valley, grazing during the growing season would cease. Existing plants should have increased production and reproductive output. Plant density may or may not increase. The response depends on factors (e.g., climate, competition, grazing and their interactions) that control population level responses, and these are largely unknown. The vegetation response in areas traditionally used by horses during the winter will probably be neutral. Palatable species are grazed largely during dormancy, which has few if any adverse effects.

The vigor of perennial bunch grasses would be expected to improve, particularly in areas where heavy utilization has occurred every spring and summer for much of the past 20 years. Herbaceous species may or may not increase in sagebrush plant communities with depleted understories. Once sagebrush canopy cover reaches about 15 percent the herbaceous component begins to decline, and approaches zero when sagebrush cover is between 25 percent and 35 percent. Many sagebrush sites in the planning area have not burned for decades, and probably have high canopy cover.

4.6.3 RIPARIAN RESOURCES

Most riparian areas in the planning area are adversely impacted by excessive grazing by either cattle (Groom Range) or wild horses (Stonewall Mountain east to the west slope of the Belted Range), or by development for domestic water supplies (Groom Range). Many appear degraded, but the BLM has conducted Proper Functioning Condition Assessments on only nine sites. All are either functional-at-risk (4) or non-functional (5). Given the general lack of livestock management, and the large horse herd over much of the previous 20 years, most other riparian areas would also probably be classified as functional-at-risk or non-functional.

Riparian areas in the Bald Mountain and Naquinta Springs grazing allotments are likely to remain degraded until the BLM either gains improved access to them or reaches agreement with appropriate Air Force units to implement proper management strategies. Appropriate grazing management strategies and practices that will benefit riparian areas can only be developed and implemented if appropriate resource specialists have adequate access.

The wild horse herd has been reduced over the past three years. Keeping the herd at the current population size, or smaller, and keeping most of the herd in Cactus Flat (particularly the north and east areas) should reduce grazing pressure at riparian areas located in the Cactus Range, east slope of the Kawich Range, Kawich Valley, the western slopes of the Belted Range, Stonewall Mountain, and the Tolicha Peak/Pahute Mesa areas. Numerous springs and riparian areas in the Cactus Range have had exclosures constructed to keep horses out, which should allow progress towards PFC.

4.6.3.1 **Alternative A**

The management objective focuses on protecting, and if necessary improving riparian areas; however, the management direction focuses all actions in only the Bald Mountain grazing allotment and the NWHR. Cattle will continue to graze Naquinta Springs allotment because security and safety constraints prevent regular access by the BLM, or the grazing permittee. It is well documented that wild horses use riparian areas outside the NWHR (i.e., the herd management area), regardless of the size of the horse population.

Many noxious weeds are known to be in the three counties that form parts of the planning areas, and others were found in similar habitat types throughout Nevada or the Great Basin. Numerous species are perennial, with deep tap roots, and are well adapted to establish in disturbed riparian areas. If insufficient attention is devoted to noxious weeds they could easily become established, increase in density, and displace desired perennial plants. Habitat quantity and quality would decline, potentially decreasing riparian functional status.

4.6.3.2 **Alternative B**

The proposed HMA reduces the number of water sources in the area used to determine AML. This may, or may not, affect the AML. The effect is unknown because reliable flow data across a period of wet and dry years are unavailable. Flow data are necessary to determine how many animals (of all species) a water source can support when environmental conditions are poor. Most of the springs in the Cactus Range are protected by exclosures, thus changing the HA, the HMA, and the area for AML determination is unlikely to adversely impact those riparian areas.

Horses primarily use riparian areas in Gold Flat and Pahute Mesa during the winter months, when ephemeral water sources are available. Widespread feed and water, cooler air temperatures, dormant vegetation, and broad dispersal of the herd results in fewer horses congregating in riparian areas, which reduces potential impacts.

Unfenced riparian areas in the AML determination unit are likely to remain degraded. They are few and small in number, but are attractants for wild horses because they provide water and forage with higher nutrient quality. An appropriate management practice would be to fence these areas and pipe some of the water to a trough outside, and preferably distant from the exclosure. Riparian areas in the remainder of the planning area should have a positive response. Use would be sporadic (ephemeral water sources are commonly used), and largely restricted to the winter months when soils are often frozen and plants are dormant. Physical damage to soils would be less or absent, and defoliation during dormancy has few, if any adverse effects on herbaceous species.

4.6.3.3 **Alternative C**

Alternative C incorporates all components of Alternative B, except it changes the location of the HA, HMA, and the area to determine the horse herd's appropriate management level (Figure 2-4). The areas designated as the HMA and area for AML determination are identical in Alternative C, and are smaller than for Alternative B. This would not be expected to significantly change impacts to riparian areas in the planning area, because most riparian areas in the Cactus Range have been fenced to exclude horses, and none have water piped outside the exclosures.

4.6.3.4 **Alternative D**

Complete removal of wild horses should provide the most benefit to riparian resources. Water would flow freely from source points, and permit full expression of the riparian vegetation. This conclusion that assumes prior developments to support mining, livestock grazing (prior to Air Force purchase of grazing privileges), and/or other historic uses, has not permanently altered a site's hydrology, making it incapable of supporting riparian vegetation. Some sites would be expected to return to a PFC, but intensively developed sites may have crossed thresholds and cannot achieve PFC without extensive engineering.

Riparian areas that have been improperly grazed would be expected to return to proper functioning condition without the construction of exclosures, provided transition thresholds had not been crossed. If transition thresholds are crossed, new steady states would develop.

4.6.4 SENSITIVE SPECIES

No flora in the planning area are listed as threatened or endangered. Many species of concern occur in the planning area, or near the planning area in habitat types similar to those in the planning area.

The desert tortoise is the only resident fauna that has been listed as threatened or endangered. There are no inventories or assessments in the planning area to determine the quantity or quality of tortoise habitat, population size, potential population size, population trend, the potential for returning degraded habitat (if present) to a higher quality, or the influence of other factors (e.g., predation) that influence population size.

Numerous avifauna that are listed as threatened or are considered SOC may traverse the planning area during spring and fall migration periods (Table 3-7). Habitat that supports these species is largely absent from the planning area, and when present, usually has poor quality. They are expected to spend little time in the planning area, and should not be affected by Air Force or BLM actions in the planning area.

The peregrine falcon, Phainopepla and Ferruginous hawk are SOC that potentially could establish year-long residency in the planning area, based on their preferred habitat requirements and year-long presence in the Great Basin and/or northern Mojave Desert regions. No populations (or individuals) are known to occur in the planning area.

The burrowing owl is known to occur in the planning area. It may establish nests in burrows constructed by other species, or in pipes or similar features constructed by humans.

Two reptilian SOC are restricted to the southern planning area. The banded Gila monster has only been found south of the planning area. The Chuckwalla prefers rocky habitats. Few, if any regular military activities occur in rocky areas, because they are not conducive to establishing targets or infrastructure associated with training pilots and testing aircraft.

Mammalian SOC present, or expected to occur, in the planning area are limited to bats (Appendix D). Bats are found in many vegetation types, but critical habitat includes springs and ponds, and roost areas associated with mines, caves, tunnels, cliffs, old growth trees, and old abandoned buildings. The Air Force conducts very few regular activities at water sources or potential roost sites.

4.6.4.1 **Alternative A**

This alternative broadly identifies protection of threatened and endangered wildlife, and their habitat (but not flora), in Section 2.2.5.3. The No-Action alternative provides no management guidelines for SOC (particularly flora) that could become listed as threatened or endangered, if perceptions about rarity and threats to survival are accurate. The absence of any focus on SOC could result in populations suffering undetected and needless declines, with species eventually being considered as candidates for listing as threatened or endangered.

4.6.4.2 **Alternatives B, C and D**

These alternatives focus management objectives and direction on both federally protected species, and SOC. Efforts to maintain, and if possible, increase both the population size and area inhabited by SOC, should reduce their potential for consideration as candidates for listing as threatened or endangered species, because of BLM or Air Force actions. Alternatives B, C and D meet the management needs of a broader suite of sensitive species than the No-Action alternative.

A reduction in the area where grazing animals primarily would be managed, as well as the reduction of number of grazing animals, would greatly enhance the potential for improved habitat conditions. The extent of this improvement is not known at this time.

4.6.5 WILDLIFE HABITAT

The amount and spatial distribution of water is the most limiting habit feature in the planning area. Breen Creek is the only perennial stream, and its flow into Cactus Flat often ceases by early to mid summer. In dry years flow into Cactus Flat can be completely absent.

Almost all springs are located in the foothills or mountains. These sources are widespread, but have a low density (i.e., often separated by several miles or more). Flow is generally low (Table B-5), and little water moves from the spring source. There are few water sources in the valley bottoms, and all are artificial. There are several water troughs available in Cactus Flat that are fed by pipelines that originate at dependable springs in the Kawich Range. Several playas in Kawich Valley, Gold Flat, and Cactus Flat have had pit reservoirs constructed. These reservoirs collect runoff following large storm events, and can provide water for extended periods during wet years. During dry years water can be depleted by mid summer. They also may serve as collection points for contaminants if excessively large amounts of chemicals are released up-gradient. Not only can drinking water supplies be potentially affected but, also, food supplies for waterfowl that use the playas when they have water.

The amount of acreage physically disturbed in the planning area is small, and most of disturbances are located in the valley bottoms. Despite a limited amounts of direct disturbance, the planning area has an extensive network of both linear and areal features (Figure 3-1). Very little is known about how the array of linear features, with active nodes at electronic warfare sites (and other infrastructure), affects habitat quality. Human activity levels may, or may not, be sufficient to reduce the quality of the habitat in some, or perhaps much, of the areas affected. Furthermore, the response may be species specific, with potential benefits for some species (e.g., ravens and coyotes), but not others (e.g., bighorn sheep). Relationships between the spatial arrangement of linear features, connected to small nodes with regular activity, and the response of fauna have not been well developed for most species in the planning area.

A widespread influence on wildlife habitat is the wild horse population. At large population sizes (probably 1,000-1,500 or more) the horses can consume most of the water, at most water sources. As population size increases the horses result in heavy and severe forage utilization over increasingly larger areas, and potentially compete with fauna for palatable forage. Unfenced springs and riparian areas outside Cactus Flat (the primary horse congregation area) are increasingly vulnerable to excessive grazing.

Another widespread influence on wildlife habitat is the internal (density and cover) and external (spatial area) expansion of PJ woodlands. As woodlands expand, desired understory shrubs, forbs, and grasses decline, reducing forage for many species. Woodland avifauna, however, probably derive beneficial short-term gains. Gains are short-term because both closed canopy and dense woodlands are very susceptible to large, catastrophic wildfire that can eliminate thousands of acres of woodland. Woodlands with high canopy cover typically lack desired understory species. Following fire, they are susceptible to invasion from introduced annual grasses that competitively exclude desired species, and can shorten the fire cycle. More frequent fires precludes the re-establishment of long-lived trees and shrubs.

A small amount of habitat in the sagebrush, salt desert shrub, transition desert scrub, and creosote/bursage associations that support neotropical migrants has been lost to the development of infrastructure, but these species remain widespread. Population and trend data for individual species, however, are not available.

Most wildlife species in the planning area are widespread (common) at the regional scale, but not necessarily abundant (i.e., large population size) at any specific location. The large number of species, and their overlapping habit requirements generally precludes a species oriented management program. A better approach is to select multiple target species (usually game animals, keystone species, indicator species, functional groups, and/or threatened or endangered species) and manage the habitat for them. This approach requires one operating assumption: if habitat requirements for the target species or groups are met, then habitat requirements for most or all other species are also met (to some degree). Habitat quantity and quality for all species may not be optimum, but is sufficient to maintain viable populations.

4.6.5.1 **Alternative A**

Some components of the No-action alternative have not been met since 1992 (see Sections 2.2.5.4 and 2.2.8.3). For example, each species has different habitat requirements. Maximum value for one is minimum value for another. Water is the primary limiting resource for fauna, thus to meet this objective, the Air Force and/or BLM would have to construct many more new water sources, than the 20 or so discussed in Section 2.2.5.4, Management Actions. Neither the BLM nor the Air Force have conducted inventories to determine all wildlife species in the NWHR and the Bald Mountain.

4.6.5.2. **Alternatives B and C**

Objective one and two and their associated management direction clearly demonstrate that wildlife need quality habitat to maintain their populations, not just a spatial area. Alternatives B and C focus on key species, and/or critical locations and resources to emphasize management actions.

The effects of wild horses on wildlife habitat are expected to be no worse, and hopefully substantially better than Alternative A. Alternatives B and C (Figures 2-3 and 2-4, respectively) redraw the herd area to reflect where horses were present in 1971, to comply with the Wild Horse and Burro Act. The critical point for management is definition of the HMA.

Alternatives B and C should benefit wildlife habitat more because they propose to keep most of the horse herd in Cactus Flat where management activities are less likely to be constrained by the Air Force's training and testing mission. Access to this area is possible almost every day. In the past, Air Force training and testing requirements have eliminated access to southern Kawich Valley for 3-5 months when emergency gathers should have occurred. The relatively large number of horses occupying a stressed environment probably led to unnecessary habitat degradation.

Alternative C is unlikely to have less of an impact on wildlife habitat in Cactus Flat, than is Alternative B, despite Alternative C having a smaller HMA. Water, not forage is the limiting factor for horses in Cactus Flat. Almost all of the springs in the Cactus Range are fenced to exclude horses, thus, they do would not contribute to determining the size of the herd. Also, they are not impacted by horses due to the closed gates.

It is important to note that expanding PJ woodlands are a threat to wildlife habitat. The extent of this impact is not known at this time, therefore, additional data and analysis of that data are required.

4.6.5.3 **Alternative D**

With respect to impacts to habitat from anthropogenic activities and the expansion of PJ woodlands, the effects from Alternative D are not different from those of Alternatives B and C. With respect to wild horses, Alternative D should provide the most benefit for wildlife habitat. All horses would be removed leaving all water supplies for wildlife. Potential competition for feed between horses and wildlife would be eliminated.

4.6.6 FORESTRY/WOODLANDS

4.6.6.1 **Forestry Products**

None of the alternatives authorizes the sale or collection of Forest Products in the planning area, due to safety and/or security constraints.

4.6.6.2 **Fire Management**

Wildfires, both large and small, have occurred throughout the planning area. They result from both natural (lightning) and human (e.g., aircraft, vehicles) ignition sources. Fires are most common in the PJ woodlands, followed by sagebrush-grass rangelands, and transition desert areas. Very few, if any fires, have occurred in the salt desert shrub and Mojave Desert scrub areas.

Observations and data from throughout the Great Basin demonstrate that the annual acreage burned by wildfires is increasing, and fires are becoming larger and more intense. Many areas are being converted to cheatgrass rangelands, with large fires at short intervals. There are no data to suggest this trend will not affect the planning area in the next 20 years.

Conditions in the planning area that indicate a high potential for large catastrophic wildfires are extensive closed canopy PJ woodlands with little or no understory; dense, decadent sagebrush; and large continuous areas with abundant cheatgrass and/or other annual grasses. The most prevalent situations in the planning area are large expanses of PJ woodlands and sagebrush with little or no herbaceous understory. The lack of desired perennial species in the understory, hence a seedbank, makes these areas very susceptible to conversion to cheatgrass following a wildfire.

Alternative A

Implementation of Alternative A focuses on fire suppression actions, once a fire has been ignited. It does not address problems associated with increasing fuel loads, the potential invasion of annual grasses following a wildfire, or potential opportunities to reduce the risk of catastrophic wildfires through controlled vegetation manipulations. The focus on only fire suppression does not permit the BLM (or the Air Force) to minimize potential adverse effects from wildfires on a suite of resources (e.g., wildlife habitat, water resources, wild horses). Adverse impacts may occur because fires will occur at sizes, intensities, and/or frequencies that alter the quality and/or quantity of forage and habitat.

Alternatives B, C and D

These alternatives ensure the BLM and Air Force would jointly develop a comprehensive fire management program that includes: 1) reducing the risk of ignition; 2) decreasing the potential for large catastrophic fire in PJ woodlands; and 3) the subsequent conversion of tree- and shrub-dominated rangelands to cheatgrass. Increased management flexibility is expected by focusing fire management on efforts to reduce the risk of unwanted fires, while maintaining cooperation between the BLM and the Air Force for the suppression of fires that occur.

4.6.7 LIVESTOCK GRAZING

Authorized cattle grazing continues in the withdrawn portion of the Bald Mountain allotment. However, resource inventories, resource assessments, and monitoring in the Groom Range are lacking, largely because of strict access restrictions imposed for security concerns. The amount of available forage for livestock was estimated at 800 AUMs, based on assuming equal production across the allotment and allocating AUMs proportionately. The need to gather sound habitat data is critical to assess the condition of the vegetation. One pipeline, with several water troughs, has been constructed in the withdrawn area. This pipeline also provides water for domestic consumption at the main ranch facilities of D4 Enterprises.

Cattle grazing occurs in the Naquinta Springs Allotment, due to drift (incidental trespass) from the Bald Mountain Allotment. The absence of an allotment boundary fence, and safety and

security constraints that preclude regular access to much of the allotment by the permittee, largely prevent the permittee from keeping cattle out of the Naquinta Springs Allotment.

4.6.7.1 **Alternative A**

Authorized grazing will continue in the withdrawn portion of the Bald Mountain Allotment, but security access restrictions exist that make it difficult to complete resource assessments, inventories, and monitoring. While the livestock operator has full access to the Bald Mountain Allotment to manage his livestock, the security restrictions make it difficult for the BLM to assess livestock movement, vegetative use and overall vegetative conditions.

4.6.7.2 **Alternatives B, C and D**

Management objectives and direction focus on determining the amount of forage available for livestock, implementing the BLM's approved standards and guidelines, aligning rangeland developments with resource needs, and developing grazing systems based on plant phenological needs.

The springs and riparian areas are the most important resource, and could be protected with exclosures. Water could be piped outside the exclosures to ensure animals have an adequate water supply, therefore not needlessly suffering from severe thirst.

4.6.8 WILD HORSES

Current operational plans include repeated "gathers" every 3 to 4 years, to maintain a population size of between 600 and 1,000 horses. This population size is the estimated AML for the entire North Range (Gary McFadden, personal communication 2001, BLM Wild Horse and Burro Specialist). The 1992 Record of Decision for the 1992 NAFRRP depicted most of the horse herd area as outside the HMA and emphasized the BLM's need to determine the 1971 HA boundary. While use pattern mapping and utilization studies have occurred, soil mapping, ESI, forage production, water production and seasonal horse movement data to support use data are lacking. Maximum population size should be based on data from years with low forage production and water availability, to reduce possible adverse impacts to critical resources. There are 20 perennial water sources (springs, seeps, troughs) within the area defined in Figure 2-3 as the 1971 HA.

All burros and almost all horses were removed from the Stonewall Mountain Area, sharply reducing competition with bighorn sheep.

4.6.8.1 **Alternative A**

Implementing the No-Action alternative is difficult based on current use patterns of the animals and the established HMA. Horses are using an extensive acreage outside of the HMA. HMAs cannot be outside of HAs.

Most of the forage and the most reliable water sources are outside the HMA identified in the 1992 Record of Decision. Regardless of population size, horses will continue to use forage and water throughout much of Cactus Flat, the Cactus Range, the Kawich Range, and Kawich Valley. Fourteen of the twenty perennial water sources would be available to the horses. However, they are likely to continue moving to Gold Flat and the Pahute Mesa area during the winter months when ephemeral water is available. Winter feed is more limited in Cactus Flat, because of grazing from spring through fall. The only way to keep wild horses from moving out of the 1992 HMA is to fence them in.

Wild horses periodically find themselves in southern Kawich Valley without adequate water, because pit reservoirs do not fill, or springs have low flow, due to below-average winter precipitation. Historically, Air Force training and testing have prevented the BLM from accessing the area as quickly as needed. However, the BLM and Air Force have recently developed a working

relationship that has allowed emergency gather operations to be accomplished underneath and/or during Red Flag Operations.

4.6.8.2 **Alternative B**

Alternative B redefines the HA and the HMA to be identical in size at 1,330,540 acres, which includes all of the northern planning area north of Pahute Mesa and west of the Belted Range and Sand Springs Valley. This HA is coincident with the estimated 1971 HA. Forage and water supplies within a 474,370 acres subunit of the HA/HMA (Figure 2-3) would be used to calculate the herd's appropriate management level. Eighteen of the twenty perennial water sources would be available to the horses. These realignments are proposed for several reasons as discussed below.

The HA was never accurately defined according to regulations that implement the 1971 Wild Horse and Burro Act. The HA was supposed to encompass the total area that wild horses used in 1971. Data from Figures 3-11 and 3-12, and from letters and memos on file with the Nevada Wild Horse Commission, indicate that horses were found in much of the proposed HA. Other areas have no records of being searched for horses, thus, they may, or may not, have been present. The presence of feed and water and the absence of physical barriers suggest most, or all, of the proposed HA/HMA was used by horses in 1971.

Much of the horse herd routinely moves from the northern half of the proposed HA/HMA to the southern half during the winter and early spring when ephemeral water sources are present. Seasonal movement occurs regardless of the herd's population size. This movement reflects the better forage availability in the southern half of the proposed HA/HMA during the winter and early spring.

This alternative would attempt to minimize the number of horses in Kawich Valley, thus, the number of horses with inadequate water supplies during periodic, severe droughts that dry up water supplies. This would minimize conflicts between Air Force operations and BLM management requirements.

Implementation would balance the herd's population size with available water and forage, from sources that have the best dependability. This should result in a healthier horse herd.

Incorporating the needs of wildlife located in the area for AML determination would reserve adequate forage and water for them. Excluding water and forage from outside the proposed area for calculating AML, would reserve scarce water supplies for other wildlife in much of the planning area. Operational conflicts between the Air Force and wild horses are expected to decline, but the unpredictable free-roaming nature of wild horses does not ensure animals will not establish bands (seasonal or permanent) in Kawich Valley that must be gathered periodically.

Alternative B would attempt to keep horses from establishing summer or year-round bands in the area encompassed by Stonewall Mountain, Tolicha Peak, and western Pahute Mesa. This should eliminate potential competition with bighorn sheep, and facilitate meeting wildlife management objectives at those locations. Potential competition with bighorns for water in the Cactus Range has been reduced by the construction of exclosures around most of the riparian areas. It is unknown if competition exists for forage. The proposal to incorporate bighorn forage requirements into the determination of AML should reduce or eliminate potential competition.

4.6.8.3 **Alternative C**

Alternative C advocates a smaller HMA that is similar to the AML Core Area of Alternative B, but excludes the Cactus Range. The Alternative C area for AML determination would be limited to the 325,220 acre HMA. This alternative could minimize conflicts with the Air Force mission.

Air Force safety concerns are primarily traffic issues on the Tonopah Test Range including the area from the housing compound in the North, to the corridor south of the airfield, through the area west of Antelope Lake. There have been two documented vehicle accidents involving horses on the NTTR in the past two years (since 1999). In comparison with other HMAs, this is a lower rate of incidents.

This alternative allows for the seasonal movement of horses outside the HMA, but the Air Force may request that BLM remove animals from outside the HMA. A typical reason for such a request would be that horses have established a permanent home range outside of the HMA. Management actions would be restricted to Cactus Flat, the NTTR area which has the least restrictive access requirements. This would facilitate Air Force activities. Implementation of Alternative C would minimize the number of horses in the Cactus Range and Kawich Valley. Twelve of the 20 (40 percent) perennial water sources would be available to the horses. This alternative could also reduce conflicts with Air Force operations.

The environmental effects from this alternative for riparian, vegetation, and wildlife resources are similar to those of Alternative B. The AML for Alternative C may be less than for Alternative B. Alternative C would provide less forage and water for calculating AML, but forage probably is not the primary factor that limits the herd's AML. Except for the springs in the Cactus Range, the water sources located in the Alternative C HMA are the same as in Alternative B. Under this alternative, the springs in the Cactus Range are excluded from wild horse use. Additionally, there are existing wells, with sufficient water rights, that may be developed for use by wild horses. Insufficient information is available for calculating AML for either Alternative B or C, thus a direct comparison is not possible.

4.6.8.4 **Alternative D**

This alternative would remove all wild horses and burros from the planning area, and remove any equids that subsequently establish herds.

Removal of the wild horses would eliminate periodic conflicts between the Air Force's training and testing mission and the BLM's mandate to manage wild horses. No horses would have to needlessly endure long periods of thirst, and/or slowly die of thirst. Also, the potential for accidental collisions between horses and vehicles would end.

4.7 CULTURAL RESOURCES AND HISTORICAL

Under all of the alternatives (A, B, C, and D), the National Historic Preservation Act necessitates that all Federal agencies take into account the effects of their undertakings on any district, site, building, structure, or object that is included in or eligible for inclusion in the NRHP. Cultural resources that are not included in, or eligible for inclusion in, the NRHP do not require protection and preservation under the law.

The historic contexts have not been developed for most of the cultural resources in the planning area (see Section 3.7). Only one historic property has been nominated to the NRHP.

The reduction in the horse population and control of livestock grazing would decrease the potential for adverse effects on historic and or prehistoric properties due to trampling.

Fire suppression would benefit certain cultural resources, such as historical mining camps or other wooden structures, by directly protecting them from damage or destruction.

4.8 LAND STATUS, DESIGNATIONS AND USES

4.8.1 ACCESS

4.8.1.1 **Alternative A**

The planning area is closed to the general public. Resource management specialists with a need to work in the planning area, and who have appropriate security clearances, would be granted access subject to safety and scheduling constraints. Access to some subunits (i.e., numbered ranges) in the planning area would remain difficult, to nearly impossible.

Local communities would continue to be denied access for the development and extraction of resources.

4.8.1.2 **Alternatives B, C, and D**

The access restrictions for Alternative A apply to the remaining alternatives.

4.8.2 LANDS PROGRAM

The two areas being returned to the BLM from the Air Force were not part of the 1999 renewal of the NTTR, and are outside the planning area. No additional land areas in the planning area are planned for return to the BLM during the duration of the existing withdrawal. The planning area is reserved for military use, but rights-of-way can traverse the planning area, subject to approval by the Secretary of the Air Force.

4.8.2.1 **Alternative A**

Alternative A permits non-military right-of-ways, but only with consent of the Secretary of the Air Force. This ensures that right-of-ways will not be placed in locations that may compromise the military's training and testing mission, or result in harm or damage to personnel and/or equipment in the right-of-way. The No-Action alternative may result in more disturbed acreage in the planning area if linear features (e.g, power lines) are constructed , but the amount is expected to be much less than the existing 2,800+ miles. Revegetation requirements attached to any right-of-ways granted could mitigate potential adverse impacts from new right-of-ways.

4.8.2.2 **Alternatives B, C and D**

All alternatives are functionally identical to Alternative A. The environmental consequences are identical.

4.8.3 NATURAL AREAS AND AREAS OF CRITICAL ENVIRONMENTAL CONCERN

4.8.3.1 **Alternative A**

The Timber Mountain Caldera is the only recognized ACEC in the planning area. There are no regular Air Force or BLM activities in the Timber Mountain Caldera. It contains no targets or infrastructure, other than a few infrequently traveled roads. The objective and management directions for Alternative A are being met.

4.8.3.2 **Alternatives B, C, and D**

The objective and management direction for Alternative B is very similar to Alternative A, and are being met. The withdrawal in essence provides an additional layer of protection for the Timber Mountain Caldera ACEC. The area cannot be accessed by the public, so no disturbance surface public use is possible. It is anticipated the BLM and the Air Force will coordinate any activities that could cause surface disturbance in the ACEC, prior to the activity occurring. At this time the BLM is unaware of any proposed ground-disturbing military activities within the ACEC.

4.8.4 RECREATION

Hunting for bighorn at Stonewall Mountain is the only recreational activity allowed in the planning area. This hunting is allowed as a mitigation for the Air Force's 1986 Groom Range withdrawal. All other areas are permanently closed to recreation, for safety and security reasons.

4.8.4.1 **Alternative A**

The No-Action alternative is not applicable. Stonewall Mountain has been open for hunting for bighorn sheep. The Air Force has not expressed any interest in reducing or eliminating sheep hunting in the planning area.

4.8.4.2 **Alternatives B, C and D**

The annual harvest is determined by the NDOW, and is based on the annual population census. Hunters are restricted to locations where they can camp and travel. These restrictions, combined with the low number of hunters, are expected to prevent hunters from traveling off-road and establishing new two-track roads that disturb habitat and increase the potential for noxious weeds becoming established at Stonewall Mountain.

4.8.5 WILDERNESS

There are no impacts to wilderness since no Wilderness Study Areas exist in the planning area.

4.9 WASTE AND HAZARDOUS MATERIALS MANAGEMENT

4.9.1 HAZARDOUS MATERIALS MANAGEMENT

No hazardous materials are manufactured in the planning area, but hazardous products (solids, liquids, and gases) are transported into the planning area, and are used during training and testing missions. Other materials are generated as byproducts of industrial activity conducted to support the training and testing mission. Most hazardous materials are concentrated at a few major industrial sites, several air-to-ground live bombing ranges, several hundred electronic warfare sites, and power substations. Appropriate best management practices (BMPs) for both storage and eventual disposal (on- and off-site) are practiced across the entire planning area, to minimize the potential for accidental release.

Despite the application of safe operating procedures, it is a fundamental reality that almost all hazardous materials on the planning area are located up-gradient of terminal playas. All overland runoff that does not infiltrate into the soil collects in the playas and evaporates. Hazardous liquids and solids that have a widespread distribution can be transported to the comparatively small playas, potentially increasing their concentration. Periodic flooding on alluvial landforms can potentially transport of contaminants located on alluvial landforms to playas. Subsequent use of this water and/or food on the playas by a wide variety of wildlife (including wild horses) potentially increases the risk of contaminants being ingested and spread to other locations. Some hazardous materials, however, such as plutonium from 1960s safety tests by the Atomic Energy Commission, are relatively stable due to their physical properties and are not generally subject to such transport and concentration.

4.9.1.1 **Alternative A**

The No-Action alternative does not address the management of contaminants. It provides no guidance about how to manage hazardous materials in the planning area.

4.9.1.2 **Alternatives B, C, and D**

These alternatives attempt to minimize the impacts of hazardous materials by adhering to BMPs associated with the regulations that implement existing laws. These are addressed in Nellis Air Force Base's HAZMART pollution prevention process. Thess alternatives also require a full NEPA analysis for all proposed actions, including an evaluation for hazardous materials, waste minimization, and pollution prevention.

4.10 SOCIOECONOMICS

4.10.1 ALTERNATIVES A, B, C, AND D

No social or economic impacts, either beneficial or adverse, were identified, and none are expected to occur as a result of proposals for management of the resources on the withdrawn lands.

Constraints upon resource utilization will continue, as they are, and existing resource utilization, within those constraints, will proceed as it has in the past.

There are no cities, towns, or communities located in the planning area, however, about seven small towns occur around the perimeter. None of these communities have economies linked to natural resources present in the planning area. Direct economic linkages between these communities and the planning area are for jobs that support the Air Force training and testing mission. Natural resources in the planning area, that could be used to support economic development, are unavailable because safety and security constraints prevent access to utilize these resources.

Pursuant to PL 106-65, the Nellis Air Force Range (now NTTR) is withdrawn from all forms of appropriation under the mining laws and the mineral leasing and geothermal leasing laws. The sale of forest products are not authorized in the planning area. Recreation, with the exception of bighorn sheep hunting in the North Planning Area, at Stonewall Mountain, is not permitted due to safety and security constraints. Bighorn sheep hunting will be permitted to continue, as before. Management prescriptions provide for continued grazing of domestic livestock on the withdrawn portion of the Bald Mountain Allotment. Authorization will continue for 800 AUMs. So existing resource utilization remains unchanged, and no economic impacts are expected.

4.11 CUMULATIVE IMPACTS

Cumulative impacts are the impacts on the environment which results from the incremental impacts of the action when added to other past, present and reasonable foreseeable future actions regardless of what agency (Federal of non-Federal) or person undertaking the action. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

Based on non-renewal of certain lands, lands added to the withdrawal in PL 99-606 and the withdrawal to DOE for Pahute Mesa, the area of cumulative impact is reduced by approximately 116,000 acres or about 4 percent.

The planning area has been withdrawn for about 55 years. It is estimated that about 100,000 acres are disturbed from Air Force tactical target complexes and associated infrastructure in the planning area. This disturbance is significantly higher than what was presented in the 1992 plan which estimated 12,000 acres. Based on a review by military personnel of their records, this estimate was in error. There has been a limited amount of surface disturbance over the past 10 years, therefore the majority of the 100,000 of disturbance occurred prior to the completion of the last planning effort, but was not identified.

There are no known projects proposed at the current time or into the reasonably foreseeable future, expect for a well in the southeast corner of the area identified for wild horse management in alternatives B and C. However, for the purpose on this analysis it is not unreasonable to expect some additional ground disturbance within the 20 year life of this plan, therefore a projection of 20-100 acres per year will be considered. Impacts to between 400 to 2,000 acres is insignificant over the life of this plan. There always is the possibility that the Air Force mission could change and land disturbance may double or triple the projected amount. This is outside the control of the BLM.

There are some non-military uses that will occur during the life of this plan including limited livestock grazing and the potential for mineral extraction on any valid existing permits that may still be in affect.

Except for the Groom Range, little to no mineral exploration or related activity has been allowed in the last 50+ years. The Groom Mountain area contains 1 unpatented mining claim, 16 patented mining claims and all or portions of two oil and gas leases. The potential exists for development of up to 1,100 acres during the life of this plan.

Based on the existing and projected land disturbance, only 4 percent of the land mass will potentially be disturbed. The vast majority of the land is protected from ground disturbing activities. No recreation expect for bighorn sheep hunts are allowed. Since the hunters are confined to existing roads there would be no cumulative impact from this activity. The acreage and percentages, and the number and intensity of impacts, would represent an insignificant cumulative impact to the human environment on the approximately 2 million acres within the planning area.

4.12 UNAVOIDABLE ADVERSE IMPACTS

The potential exists for impacts to vegetation, wild horses and wildlife which cannot be avoided during routine maintenance of existing rights-of-way.

Fencing spring and riparian areas would have a direct impact on wild horses that frequent the areas. Some springs would be closed off and no water provided for the horses. There is a direct benefit to fencing the spring area to improve the quality of the water and riparian habitat.

There would be a loss of native vegetation due to any ground disturbing activity on undisturbed sites.

A limited amount of dust from various activities such as gravel extraction and traveling graveled roads is also expected.

Short term impacts are expected to water quality by grazing animals would continue at some springs until the sources are protected by the appropriate means.

4.13 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Irreversible commitments are those that cannot be reversed except perhaps in the extreme long-term (100 years or more).

Irretrievable commitments of a resource is the loss of an opportunity for production or use of a renewable resource for a period of time.

No strictly discernable irreversible commitments of resources are anticipated by implementation of this plan.

Potential irretrievable commitments of resources include: Extraction of sand and gravel materials from a gravel pit which is closed due to only poor quality material remains. Loss or destruction of wildlife or wild horses and their habitat through construction or other activities.

There are other irretrievable commitments of resources, however these were a direct result of the withdrawal and are not due to implementation of this plan. Impacts to visual resources as a result of any construction activities. This is however expected to very limited over the life of this plan.

4.14 RELATIONSHIP BETWEEN SHORT-TERM USES OF THE HUMAN ENVIRONMENT AND MAINTENANCE OF LONG-TERM PRODUCTIVITY

Actions that improve vegetation conditions would result in an increase in long-term productivity of the resource.

Long-term productivity would be maintained within the Timber Mountain Caldera ACEC, by prohibiting surface disturbing actions. It is imperative that the BLM and Air Force work closely to ensure no surface disturbing activities are authorized in this area.

THIS PAGE DELIBERATELY LEFT BLANK

CHAPTER 5
CONSULTATION AND COORDINATION

5.1 INTRODUCTION

This chapter summarizes the preparation, public participation, consultation, and coordination activities conducted for the Draft NTTR RMP/EIS. In the course of preparing this document, formal and informal efforts have been made to involve the public, a variety of special interest groups and organizations, other federal agencies, and state and local governments in the planning process. Several steps of the planning process require that the public be provided the opportunity to participate; a number of other actions were taken to encourage further public participation.

Prior to the actual writing of the Draft RMP/EIS, a data collection effort was initiated. This process included data assembly, public participation, interagency coordination and consultation, and incorporation of the Analysis of the Management Situation. Due to a very short time frame to complete the document, data on vegetative condition were very limited. Consultation and coordination included requests to the USFWS for technical assistance in dealing with candidate species in the planning area, and numerous meetings with the general public and representatives of special interest groups organizations. Documentation of these consultation and coordination efforts and a complete mailing list of those contacted during the scoping process are on file at the Las Vegas Field Office.

5.2 LIST OF PREPARERS

The NTTR RMP/EIS was prepared with the assistance of the Desert Resource Institute, and included review from the federal agency staffs' specialists and the other affected interests on the planning team. Tables 5-1, 5-2, and 5-3 list the individuals and their responsibilities in the preparation of this document.

5.3 PUBLIC SCOPING

5.3.1 PUBLIC PARTICIPATION PROCESS

The public participation process began in May 2000 with the publication of a Notice of Intent to revise the Nellis Air Force Range Resource Plan and EIS a.k.a. (NTTR), in the *Federal Register* (Volume 65, No. 74, Monday, April 17, 2000, page 20483).

The first Notice of Intent was published in the Federal Register mainly to announce the preparation of the Nellis Plan and scoping meetings. Once the planning criteria were completed and the final determination of all cooperating agencies was made, an additional notice was published in the Federal Register that identified all required information per regulation, *Federal Register* (Vol. 66, No. 64/Tuesday, April 3, 2001, pages 17729-17730).

Scoping meetings were held the week of May 1, 2000, in Las Vegas, Amargosa Valley, Pahrump, Beatty, Tonopah and Alamo. The purpose of those meetings was to involve the public in development of resource issues on the NTTR, within the scope of the authority of the BLM. There are decisions and management directions within the existing management plan that need to be reviewed and possibly changed based on public input. All parties involved in this process are aware of the following restriction set forth in P.L. 106-65: The entire NTTR is closed to public use of any road, trail, or other portion of the lands withdrawn, for safety and national security reasons. Table 5-4 shows the date, location, and attendance for each of the six scoping meetings.

Table 5-1. List of Preparers

Name	Agency/Program Area	Qualifications & Education
DOCUMENT PREPARATION		
Jeffrey G. Steinmetz	BLM Team Leader	B.S. Range Management
Bradley W. Schultz	DRI - Draft Plan Prep. Ecology, Range Mgt.	M.S. Nat. Res. Mgt/B.S. Range Science
Gilbert F. Cochran	DRI - Proj. Mgr./Writer/Editor	Ph.D. Hydrology/ M.S. Civ. Engrg.
Tim Minor	DRI - GIS/Graphics/Maps	M.A. Geography
Richard H. French	DRI -Water Resources/ Hydrology	Ph.D. Civ. Engrg./Hydraulics
Stephen A. Mizell	DRI - Hydrogeology	Ph.D. Hydrogeology/Geology
Lonnie C. Pippin	DRI - Archaeology	Ph.D. Anthropology/Archaeology
Paul Myers	BLM - Socio-Economics	B.S. Economics
Marjory Jones	DRI - Editor	B.A. Art/Anthropology
DOCUMENT REVIEW AND REVISION COORDINATION		
Walter Buzz Todd	BLM - Geology, Minerals	B.S. Geology
Jacqueline Gratton	BLM - Lands and Reality	Realty Specialist , 20 years
Gary McFadden	BLM - Wild Horse & Burro Mgt.,	B.S. Range Animal Science
Keith Myhrer	USAF - Cult. Res./Paleontology	M.A. Anthropology
Tom Suwyn	BLM - Fire Management	Fire Management 23 years
Jack Norman	BLM - Air, Soil, Water Riparian Mgt. Noxious Weeds	B.S. Soil Science.
Donn Siebert	BLM - Wilderness / VRM	B.S. Natural Resources
Bob Taylor	BLM - GIS	B.S. Landscape Architect
Jim Campe	USAF - Env. Mgt. Tech. Coord.	B.S. Naval Arch. & Off-Shore Engineering
William Fisher	BLM - Tonopah Coordination	B.S. Fisheries & Wildlife
Susan Barrow	USAF - Env. Mgt. Coordination	B.S. Public Admin, Environ. Policy Mgt.
Lesile Monroe	NNSA - Agency Coordination	M.S. Natural Resource Management

Table 5-2. List of agency reviewers and technical support and guidance providers

Name	Title	Office
Stan Rolf	Archaeologist	BLM Las Vegas Field Office
Everett Hooper	Military Liaison	U.S. Air Force
Brad Hines	Range Conservationist	BLM Nevada State Office
Brian Amme	Planning & Env. Coord.	BLM Nevada State Office
Pat Barker	Archaeologist	BLM Nevada State Office
Stephen Smith	Outdoor Recreation Specialist	BLM Nevada State Office
Richard Arnold	Tribe Representative	Indian Center
Billie Young	National Wild Horse Association	President
Julie Gleason	Local Representative	Nevada Wild Horse Commission
Cathy Barcomb	Administrator	Nevada Wild Horse Commission
Jim Campe	NEPA Coordinator	Nellis AFB Environmental Mgt
Craig Stevenson	Wildlife	Nevada Division of Wildlife
Amy Sprunger-Allworth	Refuge Manager	USFWS
Dick Birger	Regional Director	USFWS
Ron Gregory	County Liaison	Clark County Planning
James Marble	County Liaison	Nye County NRO
Mary Ellen Giampaolli	County Liaison	Nye County NRO

Table 5-3. BLM Management Support and Guidance

Name	Title	Office
Robert V. Abbey	State Director	Nevada State Office
Meg Jensen	Deputy State Director - Lands and Resources	Nevada State Office
Tom Leshendok	Deputy State Director - Minerals	Nevada State Office
Terry Woosley	Branch Chief - Resources	Nevada State Office
Mark Morse	Field Office Manager	Las Vegas Office

Table 5-4. Scoping Meetings

DATE	LOCATION	ATTENDANCE
May 1, 2000	Beatty, Nevada	1
May 1, 2000	Tonopah, Nevada	1
May 2, 2000	Pahrump, Nevada	4
May 3, 2000	Amargosa Valley, Nevada	7
May 4, 2000	Alamo, Nevada	3
May 5, 2000	Las Vegas, Nevada	8
	TOTAL	24 attendees

5.3.2 PUBLIC MEETINGS

An open house discussion format was used with opening remarks by personnel from the BLM and Nellis Air Force Base. The following comments were provided by the public at the scoping meetings:

Beatty and Tonopah - No comments were submitted for the record, however we did receive comments from Nye County, by formal letter.

Pahrump - No written comments provided at the meeting.

Amargosa Valley - Comments from Ralph McCraken;

1. Do not reduce horse water supplies.
2. Maintain heard on Nellis Range 500-800, not 10,000.
3. Expand Wild Horse and Burro Act (WHBA) area with normal ranging activities of the horses.
4. Reach equilibrium between habitat and animals.
5. Good study area for birth control for herd improvement - introduce genetic variety for viability.
6. Continue development of water and springs for wild horses and burros.
7. Allow members of the WHOA groups access to maintain water holes and the herd. Coordinate with the military.
8. Nellis has quality animals. The herd should be maintained as a source of good adoptable animals.

Alamo - comments from Marta Agee.

1. Conduct comparative studies on and off the range for wildlife numbers based on water developed for wildlife and livestock.
2. Use Resource Advisory Council recommendation for the lowest forage production years to determine herd capacity.
3. Allow livestock grazing within the range wherever it is compatible with military activities. Two areas were identified on a map which is part of the record.
4. Recognize local economic needs, through access on the north end of the range. Consider local recruitment for jobs, and other incentives for local hiring, contracting, etc.
5. Need a north/south access road.

6. Flexibility in the plan to accommodate changes in the military mission and use areas, to fit local needs within a 20-year planning period.
7. Control Noxious Weeds
8. Review renewal comments. Marta submitted a typed set of comments, 3 pages long.

Other comments:
1. Jet fuel fumes and debris as at McCarran relating to air quality and quality of the environment, is it detrimental for people as well as animals?
2. How to balance our quality of life.
3. Sonic boom effects on animals.

Las Vegas - Comments from five people combined.
1. SAIC report is flawed!
   a. Animals range farther than 8 miles
   b. Animals eat forage other than grass
   c. Page 2-4, does WH use area = NWHR? Ask SAIC.
   d Ask SAIC to give presentation to Nevada Wild Horse Commission. They meet the 2nd Monday of each week
   e. Forage allocation parameters inaccurate too many assumptions.
2. Possibility to access the range to assist in maintaining projects, etc.
3. BLM needs to fill out NWHR access paperwork correctly for non-BLM employees, including members of the NV Wild Horse Commission. Work plan needed.
4. BLM should complete the studies identified in the existing plan.
5. Define actual 1971 herd use area and an alternative including expansion to the 1971 use area.
6. Allocate water for riparian habitat and other animals. Ensure all are in, proper functioning condition (PFC). Maintain PFC.
7. Manage range for high level of biodiversity. Native vegetation as high a percent as possible. Control of non native vegetation critical.
8. Restoration of native ungulates to pre contact levels and state of health.
9. Look at potential to develop waters in areas where no conflict with military exercises would occur. Ease pressure on existing water sources.
10. Management plan needs to consider right-of-way through Nellis range for high-level waste shipments to Yucca Mountain. Call for cooperation between Nellis and DOE.
11. The entire area needs to be evaluated for wilderness potential and areas which qualify should be managed as such. Roadless areas greater than 5,000 acres need to be identified.
12. Fire management - Allow natural fires to burn. Try to return to a more natural fire regime. Use prescribed fire as a tool to achieve vegetational mosaic.
13. Cultural resource sites need to be identified and protected.
14. Actively collect and maintain a photographic record of changes to the landscape (flora) over time.
15. How will that portion of the DNWR that is overlain by the Nellis range be managed for its wildlife values?
16. How will wilderness values be retained on the DNWR and in adjoining wilderness study areas (WSAs) including Kawich and Reveille WSAs.
17. Has this entire area been surveyed for threatened and endangered species?
18. Protection of water resources from contamination and depletion due to off-area groundwater pumping.
19. As much information on groundwater should be obtained as possible by active studies.

5.4 CONSULTATION

As mandated by Section 7 of the *Endangered Species Act*, consultation between the BLM and the USFWS is required prior to the authorization or implementation of any project which may affect any federally listed threatened or endangered plant or animal species (or their habitat). Technical assistance on candidate species was requested during the scoping period and informal consultation on listed species is on-going throughout the planning process.

Under the Free Roaming Wild Horse and Burro Act, the NDOW is afforded the responsibility of consultation in Section 3(a), which says in part, "All management activities shall be at the minimal feasible level and shall be carried out in consultation with the wildlife agency of the State wherein such lands are located in order to protect the natural ecological balance of all wildlife species which inhabit such lands, particularly endangered wildlife species."

The NDOW has been contacted concerning state-listed threatened and endangered wildlife and plant species. This resource plan is consistent with legislation protecting state-listed species. Coordination and consultation with the state will be continued throughout the planning process and during implementation.

The BLM cultural resource management program operates in accordance with 36 Code of Federal Regulations (CFR), Part 800, which outlines specific procedures for consultation between the BLM and the State Historic Preservation Officer (SHPO). A Memorandum of Agreement (MOA) (NSO-196) between the SHPO, the Advisory Council on Historic Preservation, and the BLM Nevada State Office became effective on May 28,1985; this agreement was updated in 1990. This MOA coordinates the provisions of 36 CFR 800 with existing BLM procedures, emphasizing the Bureau's planning system. The MOA also incorporates mechanisms for information exchange between BLM and the SHPO, establishes reporting standards, and defines those undertakings and activities requiring or not requiring consultation. Nellis will coordinate all required cultural surveys and reports.

5.5 COORDINATION

Coordination, as defined in this section, refers to efforts to achieve compatibility with other federal, state, and local land use plans. Public scoping represents initial efforts to coordinate with other entities; each agency listed at the end of this chapter received one or more copies of the scoping report. Most of the public scoping meetings were attended by representatives from local, state, or federal entities.

5.6 PUBLIC REVIEW OF THE DRAFT

The Draft NTTR/EIS has been distributed to more than 400 entities. All the interest cards sent which were returned as address unknown, no longer at this address, or for any other reason a name was dropped from the original list of over 1000 names, are also on file. The original and updated mailing lists are available for review in the BLM Las Vegas Field Office.

CHAPTER 6
PLAN IMPLEMENTATION, MAINTENANCE, AND AMENDMENT

6.1 INTRODUCTION

The Nevada Test and Training Range (NTTR) Resource Management Plan (RMP) is designed to provide the framework for managing those public lands administered by the BLM within the withdrawn land area, for a period of 20 years. To accomplish this goal, the planning process must provide for changes in the terms, conditions, and decisions of the resource management plan in response to unforeseen future demands or events.

6.2 PLAN IMPLEMENTATION

Following approval of the resource management plan, the BLM will implement the management actions of this plan. The following standard operating procedures will be followed during plan implementation to mitigate the impacts of those management actions.

1. Management actions will conform to all laws, Executive Orders, regulations, Memoranda of Understanding, Cooperative Management Agreements, Department of Interior manuals, BLM manuals, and BLM Instruction Memoranda.

2. All management and land use actions will require an environmental analysis prior to implementation. The environmental assessment process will evaluate the proposed action for conformance with applicable laws and regulations. If the assessment determines there is potential for significant adverse impacts that cannot be mitigated, the proposed action will be modified, abandoned or an environmental impact statement will be completed.

6.3 PLAN MAINTENANCE

The NTTR RMP will be maintained as necessary to reflect minor changes in data. Examples include changing acreage figures to reflect recent land disposals or acquisitions, changing language to reflect new legislation, and to provide new language clarifying a decision, term, or condition. Plan modification cannot expand the scope of a resource use or a restriction, nor can it change the terms, conditions, and decisions of an approved RMP. These can only occur through a plan amendment. Minor refinements do not require formal public involvement, interagency coordination, or the preparation of an environmental assessment or environmental impact statement. Any maintenance must, however, be documented in the plan and supporting records.

6.4 PLAN AMENDMENTS

The *Federal Land Policy and Management Act* (1976) requires that all actions occurring on public land conform to an approved land use-plan. The BLM regularly receives proposals, applications, and requests for uses that are not in conformance with an approved land-use plan. Approval of any of these proposals would alter the scope of a resource use or use restriction; or change the terms, conditions, or decisions of the RMP. In this situation, the BLM has two options: (1) to deny the request or application, based on non-conformance with the approved land use plan, or (2) to initiate the plan amendment process. The plan amendment process may also be initiated at any time by the BLM State Director, in response to new data obtained from plan monitoring and evaluation; new or revised policy; changes in the scope of a resource use or a use restriction; and any changes in the terms, conditions, or decisions of the Resource Management Plan.

The decision to initiate the plan amendment process does not guarantee that the proposed plan amendment will be approved. The proposed amendment will be analyzed in accordance with the planning regulations and receive an appropriate level of environmental analysis, public

participation, and interagency coordination (including consistency determinations with other approved Federal, state, and local land-use plans), prior to the BLM's final decision.

Based on the significance of the anticipated environmental impacts from the specific proposal and the significance of the anticipated change to the RMP, plan amendments are categorized as described below:

EA Level - The proposed amendment, based on preliminary analysis, would not involve a significant change in the goals, objectives, terms, conditions, or decisions of the RMP and would not result in a significant environmental impact. An Environmental Impact Statement would not be required, and the proposed plan amendment would be analyzed in an environmental assessment.

EIS Level - The proposed amendment, based on preliminary analysis, would involve a significant change in the goals, objectives, terms, conditions, or decisions of the RMP, and would result in a significant environmental impact. An Environmental Impact Statement would, therefore, be required.

6.4.1 PLAN AMENDMENT PROCESS

Any plan amendment to the NTTR RMP would follow basically the same land-use planning process used in creating RMPs. It will differ based on the level of analysis required, either EA or EIS. The actual steps and basic time frames are identified below.

Plan amendments are most often prompted by the need to:

1. Consider a proposal or action that does not conform to the plan.
2. Implement new or revised policy that changes land use decisions such as an approved Conservation Agreement between BLM and the USFWS.
3. Respond to new, intensified, or changed uses on public land.
4. Consider new information from resource assessments, monitoring, or scientific studies that change land use-plan decisions.

If a determination is made by the Las Vegas BLM Field Office Manager to proceed with the amendment process, the proposed plan amendments will be presented to the Resource Advisory Council for discussion and recommendations. The Council will serve only in an advisory capacity and its recommendations will not be binding on the Field Office Manager.

The recommendations of the Field Office Manager and the Resource Advisory Council will be forwarded to the BLM Nevada State Director, who will decide to either:

- Reject the proposed plan amendment, in which case the requestor will be notified of the decision and its rationale, or

- Further consider the proposed plan amendment, in which case the State Director will determine the level of environmental analysis for the plan amendment. The Bureau will then proceed with the amendment process, as indicated below.

6.4.1.1 **EA Level Amendment**

- Issue Notice of Intent (NOI) to prepare a plan amendment.
- Provide a 30-day public review and comment period.
- Identify issues related to the proposed plan amendment and review existing RMP planning criteria. Revise the planning criteria, if necessary, and provide for public comments on the revised criteria. Collect necessary data, review the existing Analysis of

the Management Situation as it applies to the proposed amendment, and revise as needed. Formulate alternatives and estimate effects of implementing any of these alternatives.
- Prepare Environmental Assessment (EA) and Finding of No Significant Impact (FONSI).
- Provide for a 60-day Governor's Consistency Review.
- Issue Notice of Availability (NOA) for Proposed Plan Amendment/EA/FONSI.
- Provide a 30-day protest period.
- Resolve any protests.
- Prepare Approved Plan Amendment/Decision Record.

6.4.1.2 **EIS Level Amendment**

- Issue NOI to prepare a Plan Aamendment/EIS.
- Provide a 30-day public scoping period.
- Identify issues related to the proposed plan amendment and review existing RMP planning criteria. Revise the criteria, if necessary, and provide for public comments on the revised criteria. Collect necessary data, review the existing Analysis of the Management Situation as it applies to the proposed amendment, and revise as necessary. Formulate alternatives and estimate the effects of implementing any of these alternatives.
- Prepare Draft Plan Amendment/EIS.
- Provide for a 90-day public comment and review period.
- Analyze comments and prepare Proposed Plan Amendment/Final EIS.
- Issue NOI for Proposed Plan Amendment/Final EIS.
- Provide a 30-day protest period and a 60-day Governor's Consistency Review.
- Resolve any protests.
- Prepare Approved Plan Amendment/Record of Decision.

6.4.2 PLAN AMENDMENT INFORMATION

All requests for amendment must be submitted to the Las Vegas BLM Field Office Manager at the following address:

Bureau of Land Management
Attention: Field Office Manager
4765 Vegas Drive
Las Vegas, NV 89108

THIS PAGE DELIBERATELY LEFT BLANK

CHAPTER 7
LITERATURE CITED

AIWS (American Indian Writers Subgroup). 1997. American Indian perspectives to the Legislative Environmental Impact Statement for the Nellis Air Force Range Renewal, Nevada (Draft). Native American Resource Document. Prepared by AIWS Consolidated Group of Tribes and Organizations.

Alcorn, J.R., 1988. The birds of Nevada. Fairview West Publishing, Fallon, Nevada.

Arnold, J. F., D. A. Jameson, and E. H. Reid. 1964. The pinyon-juniper type of Arizona: effects of grazing, fire, and tree control. USDA Forest Service, Production Research Report 34. 28 p.

Astroth, K. A. and N. C. Frischknecht. 1984. Managing Intermountain rangelands – research on the Benmore Experimental Range, 1940-1984. Intermountain Forest and Range Experiment Station. General Technical Report INT-175. Ogden Utah. 44 pp.

Bair, J. 1998. Research needs for development of a long-term management plan for Steamboat buckwheat. Unpublished report. United States Fish and Wildlife Service, Reno. NV

Ball, S. H. 1907. A Geological Reconnaissance in Southwestern Nevada and Eastern California. U. S. Geological Survey Bulletin 308. Re-published as Ball, S. H. Mines of Silver Peak Range, Kawich Range and other Southern Nevada Districts. Published by Stanley Paher, Nevada Publications, Las Vegas, NV.

Barney, M. A. and N. C. Frischknecht. 1974. Vegetation changes following fire in the pinyon-juniper type of west-central Utah. Journal of Range Management 27:91-96.

Beale, D. M. and A. D. Smith. 1973. Mortality of pronghorn antelope fawns in western Utah. Journal of Wildlife Management 37:343-352.

Beatley, J. C. 1966. Ecological status of introduced Brome grasses (*Bromus* spp.) in desert vegetation of southern Nevada. Ecology 47:548-554.

Beatley, J. C. 1976. Vascular plants of the Nevada Test Site and Central-Southern Nevada: ecologic and geologic distributions. National Technical Information Service. 308 pp.

Beckstead, J., S. E. Meyer, and P. S. Allen. 1993. A comparison of the effects of after ripening on cheatgrass (*Bromus tectorum*) and squirreltail (*Elymus elymoides*) germination. In: Abstracts of papers, eighth wildland shrub symposium, arid land restoration.; October 19-21, 1993; Las Vegas, NV; Shrub Research Consortium.

Bergin, K. A., C. S. Crownover, C. Stevens, R. Stockton, S. Vaughan, D. Jenkins, R. Brooks, D. Ferraro, A. Turner, L. Kirkberg, P. Olson, R. Maus, G. Stough, R. Scheuch, and G. Tullis.. 1979. Final report of the 1978 archaeological investigations of the Nellis Bombing and Gunnery Range, Nye, Lincoln and Clark Counties, Nevada. Archaeological Research Center, Report No. 1-8-3, Museum of Natural History, University of Nevada, Las Vegas.

Berry, K. H. 1975. Desert tortoise relocation project. Status Report for 1973. Contract F-9353. State of California, Division of Highway, Desert Tortoise Project.

Berry, K. H. 1984. The distribution and abundance of the desert tortoise in California from the 1920's to the 1960's and a comparison with the current situation. Pages 118-153. In: K. H. Berry (ed), The status of the desert tortoise (*Gopherus agassizii*) in the United States. Report to the U. S. Department of Interior, Fish and Wildlife Service on Order No. 11310-0083.

Berry, K. H. 1988. The status of desert tortoise populations in the Western Mojave Desert. A briefing paper to the Tortoise/Sheep Technical Review Team. USDI Bureau of Land Management, Desert District, Riverside, CA.

Berry, H. B. and P. Medica. 1995. Our living resources. A report to the Nation on the distribution, abundance, and health of U.S. plants, animals, and ecosystems. U.S. Department of the Interior-National Biological Service. Washington, D.C.

Best, M. G., E. H. Christiansen, and R. H. Blank, Jr. 1989. Oligocene Caldera Complex and calc-alkaline tuffs and lavas of the Indian Peak volcanic field, Nevada and Utah. Geological Society of America Bulletin 101:1076-1090.

Billings, W. D. 1950. Vegetation and plant growth as affected by chemically altered rocks in the western Great Basin. Ecology 31:62-74.

Billings, W. D. 1994. Ecological impacts of cheatgrass and resultant fire on ecosystems in the western Great Basin. Pp. 22-30. In: Proceedings — Ecology and Management of Annual Rangelands; Boise, Idaho, May 18-22, 1992. USFS General Technical Report INT-GTR-313.

Blackburn, W. H. and P. T. Tueller. 1970. Pinyon and juniper invasion in black sagebrush communities in east-central Nevada. Ecology 51:841-848.

BLM (Bureau of Land Management). 1974. Tonopah resource management plan and supplement to the final environmental impact statement. U.S. Department of the Interior, Tonopah, NV.

BLM, 1979a. Caliente management framework plan. Las Vegas District, Caliente, NV.

BLM,1979b. Final environmental impact statement, proposed domestic livestock grazing management program for the Caliente area. Las Vegas District Office. September 1979.

BLM, 1981. Final environmental impact statement, proposed public land withdrawal, Nellis Air Force Bombing Range, Nye, Clark, and Lincoln Counties.

BLM. 1984. Nevada wild horse range herd management area plan. Caliente Resource Area. Las Vegas District, NV.

BLM, 1986. Visual Resource contrast rating. BLM Manual Handbook 8431-1, Washington D.C.

BLM. 1988. Rangewide plan for managing desert bighorn sheep habitat on public lands.

BLM, 1990. Nellis Air Force Range Proposed resource plan and final environmental impact statement. Las Vegas District Office. January 1990.

BLM, 1992. Approved Nellis Air Force Range Resource Plan and Record of Decision. Las Vegas District Office, Las Vegas, NV, 89126.

BLM. 1999. Proposed Caliente Management Framework Amendment and Final Environmental Impact Statement for Management of Desert Tortoise Habitat. Ely Field Office, NV

Borysenko, M. and S. Lewis. 1979. The effect of malnutrition on immunocompetence and whole body resistance to infection in Chelydra serpentina. Dev. Comp. Immunology 3:89-100.

Brown, J. H. and E. J. Heske. 1990. Control of desert grassland transition by a keystone rodent guild. Science 250:1705-1707.

Bryan, D. P., J. G. Vineis. 1983. Concrete and aggregate investigation and testing program, Phase III, TTR Operations. Unpublished report prepared for Holmes and Narver, Inc., Tonopah, Nevada. 17 pp and appendices.

Burge, B. L. 1979. A survey of the present distribution of the desert tortoise (*Gopherus agassizii*) in Arizona. Contract No. Y5A-512-Ct8-108.

Burge, R. B. and W. G. Bradley. 1976. Population density, structure, and feeding habits of the desert tortoise (*Gopherus agassizii*), in a low desert study area of southern Nevada. Proceedings of the 1976 Symposium of the Desert Tortoise Council. March 23-24, Las Vegas, Nevada: 51-74.

Bury, R. B. 1977. Effects of off-road vehicles on vertebrates in the California Desert. Wildlife Research Report 8. U. S. Department of Interior, Fish and Wildlife Service, Washington, D.C. 223 pp.

Bury, R. B. and R. A. Luckenbach. 1986. Abundance of desert tortoise (*Gopherus agassizii*) in natural and disturbed habitats. U. S. Department of the Interior, Fish and Wildlife Service, National Ecology Research Center, Ft. Collins, CO. 24 pp.

Byers, F. M., Jr., W. J. Carr, and P. P. Orkild, W. D. Quinlivan, and K. A. Stewart. 1976. Volcanic suites and related cauldrons of the Timber Mountain-Oasis Valley caldera complex, southern Nevada. U. S. Geological Survey, Professional Paper 919, Washington, D.C.

Byers, F. M., Jr., W. J. Carr, and P. P. Orkild. 1989. Volcanic centers of southwestern Nevada: evolution of understanding, 1960-1988. Journal of Geophysical Research 94(B5):5908-5924.

Caldwell, M. M.. 1979. Physiology of sagebrush. Pages 74-83. In: Anonymous. The Sagebrush Ecosystem: A Symposium. College of Natural Resources. Utah State University. Logan.

Coombs, E. M. 1977. Wildlife observations of the hot desert region, Washington County, Utah, with emphasis of reptilian species and their habitat in relation to livestock grazing. Report from the Utah Division of Wildlife Resources.

Coombs, E. M. 1979. Food Habits and Livestock Competition With the Desert Tortoise on the Beaver Dam Slope, Utah. Proceedings of the Desert Tortoise Council 1979:132-147.

Cornwall, H. R. 1972. Geology and mineral deposits of southern Nye County, Nevada. Bulletin 77. Nevada Bureau of Mines and Geology. Mackay School of Mines, University of Nevada, Reno.

Dahl, B. E. and D. W. Hyder. 1977. Developmental morphology and management implications. Pp. 257-290. In: R. E. Sosebee (ed) Rangeland Plant Physiology. Society for Range Management. Denver, Colorado.

Dames and Moore. 1995. Nevada Archaeological Relocation and Re-cordation Survey. Nellis Range Complex. Las Vegas, NV.

Dames and Moore. 1996. Nellis Air Force Range Wetlands Survey Draft Report. Dames and Moore Job Number 13747-088-001. 35 pages plus appendices.

Dasman. R. F. 1981.Wildlife Biology. New York. Wiley and Sons. 212 pp.

Dempster, L. T. and F. Ehrehdorfer. 1965. *Galium hilendiae* Demp. And Ehrend. Ssp. *Kingstonense* (Demp.). Brittonia 17:311.

DOE (U.S. Department of Energy), 1996. Final environmental impact statement for the Nevada Test Site and off-site locations in the State of Nevada, DOE/EIS-2043. Nevada Operations Office, Las Vegas NV. August

DOE. 1998. The Nevada Test Site Resource management plan. U.S. Department of Energy, Nevada Operations Office, Las Vegas.

Dunn, W. C. 1993. Use of springs by desert bighorn sheep before and after removal of feral burros. Desert Bighorn Council Transactions 37:11-15.

EG&G/EM (EG&G Energy Measurements). 1991. The distribution and abundance of desert tortoises on the Nevada Test Site. Report no. 10617-2081.EG&G/EM Santa Barbara Operations, Goleta, CA. 41 pp.

EG&G/EM, 1992. Yucca Mountain biological resources monitoring program. Annual report FY 91. Report no. 10617-2127. EG&G/EM Santa Barbara Operations, Goleta, CA.

EG&G/EM, 1993. Yucca Mountain biological resources monitoring program. Annual report FY92. Report no.10617-2081. EG&G/EM Santa Barbara Operations, Goleta, CA.

Ekren, E. B., R. E. Anderson, P.O. Orkild, and E. N. Hinrichs. 1971. Geology of southern Nellis Air Force Base Bombing and Gunnery Range, Nye County, Nevada. U. S. Geological Survey Professional Paper 651.

Erdman, J. A. 1970. Pinyon-juniper succession after fire on residual soils of Mesa Verde, Colorado. Brigham Young University Science Bulletin Biology Series 11(2):1-247.

Esque, T. C. 1994. Diet and diet selection of the desert tortoise (*Gopherus agassizii*) in the northeastern Mojave Desert. M. S. Thesis. Colorado State University, Ft. Collins, CO.

Esterla, D. A. 1973. Ecology of 18 species of *Chiroptera* at Big Bend National Park, Texas. Northwest Missouri State University Studies. 34:1-165.

Evans, R. A. and J. A. Young. 1970. Plant litter and establishment of alien annual weed species in rangeland communities. Weed Science 18:697-703.

Evans, R. A. and J. A. Young. 1972. Microsite requirements for establishment of annual rangeland weeds. Weed Science 20:350-356.

Everett, R. L. and S. Koniak. 1981. Understory vegetation in fully stocked pinyon-juniper stands. Great Basin Naturalist 41:467-475.

Fagerstone, K. A. and C. A. Ramey. 1996. Rodents and lagomorphs. Pp. 83-132. In: P. R. Krausman (ed). Rangeland wildlife. Pp. 88-132. Society for Range Management. Denver, Colorado. 440 pp.

Falk, D. A. 1997. Endangered species in botanic gardens. In: Conservation and management of rare and endangered plants, pp 553-562.. Ed. T. S. Elias. California Native Plant Society. Sacramento, California..

Fenton, M. B., D. C. Tennant, and J. Wyszecki. 1987. Using echolocation calls to measure the distribution of bats: the case of *Euderma maculatum*. Journal of Mammalogy 68:142-144.

Fowler, M. E. 1976. Respiratory diseases in captive tortoises. Proceedings of the Desert Tortoise Council 1976:89-98

Garcia, J., K. H. Berry, and P. B. Schneider. 1982. Distribution and relative abundance of desert tortoises (*Gopherus agassizii*) in Coyote Springs Valley, Nevada. Proceedings 1982 Symposium of the Desert Tortoise Council, Long Beach, CA.

Gates, D. H., L. A. Stoddart, and C. W. Cook. 1956. Soil as a factor influencing plant distribution on salt deserts of Utah. Ecological Monographs 26:155-175.

Given, D. R. 1994. Principles and practice of plant conservation. Timber Press. Portland, Oregon. 292 pp.

Grover, M. And L. Defalco. 1995. Desert Tortoise (*Gopherus agassizii*): Status-of Knowledge Outline with References. U. S. Department of Agriculture, General Technical Report Int-Gtf-316.

Gruell, G. E. 1999. Historical and modern roles of fire in pinyon-juniper. Pp 24-28. In: Proceedings: ecology and management of pinyon-juniper communities within the Interior West; 1997 September 15-18; Provo, UT. Proceedings, RMS-9 Ogden, Utah.

Hanley, T. A. and K. A. Hanley. 1982. Food Resource Partitioning by sympatric ungulates on Great Basin Rangeland. Journal of Range Management 35:152-158.

Harper, K. T., R. Van Buren, and S. G. Kitchen. 1996. Invasion of alien annuals and ecological consequences in salt desert shrublands of western Utah. Pp 58-65. In: J. R. Barrow, E. D. McArthur, R.. E. Sosebee, and R. J. Tauach (compilers), Proceedings: Shrubland ecosystem dynamics in a changing environment. USDA Forest Service, Intermountain Research Station, General Technical Report INT-GTR-338. Ogden Utah. 275 pp.

Harrill, J.R., J. S. Gates and J. M. Thomas. 1988. Major ground-water flow systems in the Great Basin region of Nevada, Utah, and adjacent states. U. S. Geological Survey Hydrologic Investigations Atlas HA-694-C, 2 sheets.

Harris, G. A. 1967. Some competitive relationships between *Agropyron spicatum* and *Bromus tectorum*. Ecological Monographs 37:89-111.

Hayward, C. L., M. L. Killpack, and G. L. Rickard. 1963. Birds of the Nevada Test Site. Brigham Young University Science Bulletin. Bio Series Number 3.

Herron, G.B., C.A. Mortimore, and M.S. Rawlings, 1985. Nevada raptors, their biology and management. *NDOW Biological Bulletin* No. 8.

Hironaka, M. 1961. The relative rate of root development of cheatgrass and medusahead. Journal of Range Management 14:263-267.

Hironaka, M. 1986. Habitat type, range site, and community type. pp. 15-18. In: McArthur, E. Durant, B. L. Welch. (compilers). Proceedings – symposium on the biology of Artemisia and Chrysothamnus; 1984 July 9-13; Provo, UT. General Technical Report INT-200. Ogden, UT. U. S. Department of Agriculture, Forest Service, Intermountain Research Station. 398 pp.

Hohman, J. P. and R. D. Ohmart. 1978. Historical range use of the Beaver Dam Slope, Arizona, and its possible effects on the desert tortoise population. Proceedings of the Desert Tortoise Council 1978:116-125.

Hohman, J. P. and R. D. Ohmart. 1980. Ecology of the desert tortoise on the Beaver Dam Slopes, Arizona. Report to the U. S. Department of the Interior, Bureau of Land Management, Arizona Strip District Office, St. George, UT. Contract Ya-510-Ph7-54.

Holzworth, G. C. 1972. Mixing heights, wind speeds, and potential of urban air pollution throughout the contiguous United States. Environmental Protection Agency. Office of Air Programs. Research Triangle Park, North Carolina.

Houghton, J. G., C. M. Sakamoto, and R. O. Gifford. 1975. Nevada's weather and climate. Special Publication 2. Nevada Bureau of Mines and Geology. McKay School of Mines. University of Nevada Reno. Reno, Nevada.

Huber, N. K. 1988. Late Cenozoic Evolution of the Upper Amargosa River Drainage System, Southwestern Great Basin, Nevada and California. U. S. Geological Survey, Open File Report 87-617, Menlo Park, CA.

Hulburt, L. C. 1955.Ecological Studies of Bromus tectorum and other annual brome grasses. Ecological Monographs 25:181-213.

Humphrey, R. R. 1974. Fire in the deserts and desert grasslands of North America. pp. 365-400. In: T.T. Kozlowski and C.E. Ahlgren (eds). Fire and ecosystems. Academic Press, New York, NY.

Hunter, R. L. 1991. Bromus invasions on the Nevada Test Site: present status of B. rubens and B. tectorum with notes on their relationship to disturbance and altitude. Great Basin Naturalist 51:176-182.

Johnson, M. K. 1979. Foods of primary consumers on cold desert shrub-steppe of southcentral Idaho. Journal of Range Management 32:365-368.

Karl, A. 1980. Distribution and relative densities of the desert tortoise in Nevada. Proceedings of the Desert Tortoise Council, Symposium. Pages 75-87.

Karl, A. 1981. The distribution and relative densities of the desert tortoise, *Gopherus agassizii*, in Lincoln and Nye Counties, Nevada. Proceedings of the Desert Tortoise Council, Symposium 1981. Pages 76-92.

Keystone Center. 1998. Keystone Dialogue on Nellis Air Force Range Stewardship. Keystone Center, Keystone, CO. 79 pp plus Appendices.

Klemmdeson, J. O. and J. G. Smith. 1964. Cheatgrass *(Bromus tectorum L.)*. Botanical Review 30:226-262.

Klopatek, J. M. 1987. Nutrient pattens and succession in pinyon-juniper ecosystems of northern Arizona. Pp. 391-396. In: Pinyon-juniper Conference, Reno. Nevada. January 13-16, 1986. USDA Forest Service General Technical Report INT-215.

Knight, T. and F. Smith. 1994. An inventory for rare, threatened, endangered, and endemic plants and unique communities on Nellis Air Force Bombing and Gunnery Range, Clark, Lincoln, and Nye Counties, Nevada. Legacy Resource Management Program Contract Number M67004-91-D-0010-S401. 68 pages + Appendices.

Knight, T. and F. Smith. 1995. An inventory for rare, threatened, endangered, and endemic plants and unique communities on Nellis Air Force Bombing and Gunnery Range, Clark, Lincoln, and Nye Counties, Nevada. Volume II. Legacy Resource Management Program Support Agreement FB4852-942000-071. 59 pages + Appendices

Knight, T., F. Smith, and D. Pritchett. 1997. An inventory for rare, threatened, endangered, and endemic plants and unique communities on Nellis Air Force Bombing and Gunnery Range, Clark, Lincoln, and Nye Counties, Nevada. Volume IV. Final Report. Part B. The Maps.

Koniak, S. 1985. Succession in pinyon-juniper woodlands following wildfire in the Great Basin. Great Basin Naturalist 45:556-566

Koniak, S. 1986. Tree densities on pinyon-juniper woodland sites in Nevada and California. Great Basin Naturalist 46:178-184.

Krausman, P. R., M. E. Weisenberger, M. c. Wallace, B. Czech, D. W. De Young. And O. E. Maughan. 1996. Behavioral responses of mule deer and mountain sheep to simulated aircraft noise. Desert Bighorn Council Transactions 40:1-7.

Krysl, L. J., M. E. Hubbert, B. F. Sowell, G. E. Plumb, T. K. Jewett, M. A. Smith, and J. W. Waggoner. 1984. Horses and cattle grazing in the Wyoming Red Desert, I. Food habits and dietary overlap. Journal of Range Management 37:72-76.

Koniak, S. 1985. Succession in pinyon-juniper woodlands following wildfire in the Great Basin. Great Basin Naturalist 45:556-566

Koniak, S. 1986. Tree densities on pinyon-juniper woodland sites in Nevada and California. Great Basin Naturalist 46:178-184.

Leonard, M. L. and M. B. Fenton. 1983. Habitat use by spotted bats Euderma maculatum (*Chiroptera: Vespertilionidae*): roosting and foraging behavior. Canadian Journal of Zoology. 61:1487-1491.

Leopold, L. B. 1951. Rainfall frequency: an aspect of climatic variation/ Trans. AGU, v.32, No.3, pgs 347-357

Leslie, D. M. 1978. Differential utilization of water sources by desert bighorn sheep in the River Mountains, Nevada. Transactions of the Desert Bighorn Council. 23-26.

Longwell, C. R. E. H. Pampeyan, B. Bowyer, and R. J. Roberts. 1965. Geology and mineral resources of Clark County, Nevada. Nevada Bureau of Mines Bulletin 62, Reno.

Lucas. P. 1978. State report - Nevada. proceedings of the 1978 symposium of the Desert Tortoise Council; April 1-3, 1978. Las Vegas, NV: 46-47.

Lucas, P. 1979. State report-Nevada. proceedings of the 1979 symposium of the Desert Tortoise Council.; March 24-26, 1979. Tucson, AZ: 95-96.

Luckenbach, R. A. 1982. Ecology and management of desert tortoise (*Gopherus agassizii*) in California. pp. 1-37. In: R. B. Bury (ed), North American Tortoises: Conservation and Ecology. U. S. Fish and Wildlife Service, Wildlfie Research Report 12.

Mayhew, W. W. 1968. Biology of desert amphibians and reptiles. Desert Biology Vol. 1. Academic Press. New York, New York. Pages 195-356.

McAdoo, J. K., C. C. Evans, B. A. Roundy, J. A. Young, and R. A. Evans. 1983. Influence of hetermyid rodents on *Oryzopsis hymenoides* germination. Journal of Range Management 36:61-64.

McCarty, C. W. and J. A. Bailey. 1994. Habitat requirements of desert bighorn sheep. Special Report Number 69. Colorado Division of Wildlife, Terrestrial Wildife Research. 27 pp.

McLendon, T. and E. F. Redente. 1994. Role of nitrogen availability in the transition from annual dominated to perennial dominated seral communities. pp. 352-362. In: Monsen, S. B. and S. G. Kitchen (eds). Proceedings – Ecology and management of annual rangelands. General Technical Report INT 313. Ogden, UT. U. S. Department of Agriculture, Forest Service, Intermountain Research Station.

McLendon, T. and E. F. Redente. 1991. Nitrogen and phosphorus effects on secondary succession dynamics on a semiarid sagebrush site. Ecology 72:2016-2024.

McLendon, T, and E. F. Redente. 1992. Effects of nitrogen limitation on species replacement dynamics during early secondary succession on a semiarid sagebrush site. Oecologia 91:312-317.

McQuivey, R. P. 1978. The bighorn sheep of Nevada. Biological Bulletin No. 6. Nevada Department of Fish and Game. Final Report, Federal Aid in Wildlife Restoration. Project W-48-R-8. Study r-III. 81 pp.

Miller, R. F., R. J. Tausch, and W. Waichler. 1999. Old-growth juniper and pinyon woodlands. Pp. 375-384. In: Proceedings: ecology and management of pinyon-juniper communities within the Interior West: 1997 September 15-18; Provo, UT Proc. RMS-P-9. Ogden, Utah.

Monsen, S. B. 1994. The competitive influences of cheatgrass (Bromus tectorum) on site restoration. Pages 43-50 in USDA Forest Service General Technical Report, INT-313.

Monson, B. L. and L. Sumner. 1980. The desert bighorn – its life history, ecology and management. University of Arizona Press, Tucson. 370 pp.

Mortimore, C. and P. Schneider. 1983. Population studies of the desert tortoise (*Gopherus agassizii*) in the Piute Valley study plot of Southern Nevada. Report to the Nevada Department of Wildlife. 78 pp.

Nagy, K. and P. Medica. 1986. Physiological ecology of desert tortoises in southern Nevada. Herpetological 42:73-92.

NERC (National Ecology Research Center). 1990. Assessment of biological information for listing the desert tortoise as and endangered species in the Mojave Desert. National Ecololgy Research Center. Ft. Collins, CO.

NOAA (National Oceanic and Atmospheric Administration). 1980. Local climatological data. National Climatic Center, Asheville, North Carolina.

Noble, D. C., S. I. Weiss, and E. H. McKee. 1991. Magmatic and hydrothermal activity, caldera geology, and regional extension in the western part of the southwestern Nevada volcanic field. In: G. L. Raines, R. E. Lisle, R. W. Shafer, and W. Wilkinson (eds). Geology and ore deposits of the Great Basin: Symposium Proceedings, Geological Society of Nevada, 913-934.

O'Farrell, T. P. and L. A. Emery. 1976. Ecology of the Nevada Test Site: a narrative summary and annotated bibliography. U. S. Department of Energy Report Number NVO-167. 249 pp.

Oldemeyer, J. L. 1994. Livestock grazing and the desert tortoise in the Mojave Desert. Biology of the North American tortoises. Washington, D.C. U. S. Department of the Interior, National Biological Survey 1994:95-103.

Peterson, F. E. 1981. Landforms of the basin and range province defined for soil survey. Nevada Agricultural Experiment Station, Max C. Fleischman College of Agriculture, University of Nevada, Reno. 52 pp.

Philips, F. J. 1909. A study of pinyon pine. Botanical Gazette 43:216-223.

Prudic, D. E., J. R. Harrill and T. J. Burbey. 1995. Conceptual evaluation of regional ground-water flow in the carbonate-rock province of the Great Basin, Nevada, Utah, and adjacent states. U. S. Geological Survey Professional Paper 1409-D, 102 p.

Quade, J., M. D. Mifflin, W. L. Pratt, W. McCoy, and L. Burckle. 1995. Fossil spring deposits in the Southern Great Basin and their implications for changes in water-table levels near Yucca Mountain, Nevada, during Quaternary Time. Geological Society of America Bulletin 107:213-230.

Robbins, W. W., A. S. Crafts, and R. N. Raynor. 1952. Weed Control. McGraw Hill Book Company, Inc. 503 pp.

Robertson, J. H. 1972. Competition between big sagebrush and crested wheatgrass. Journal of Range Management 25:156-157.

Schlatterer, E. F. and E. W. Tisdale 1969. Effects of litter of Artemisia, Chrysothamnus, and Tortula on germination and growth of three perennial grasses. Ecology 50:869-873.

SAIC. 1999. Range Condition survey and appropriate management level of wild horses on the Nevada Wild Horse Range, Nye County, Nevada. Final Report.

Sawyer, D. A., R. J. Fleck, M. A. Lanphere, R. G. Warren, D. E. Broxton, and M. R. Hudson. 1994. Episodic caldera volcanism in the Miocene southwestern Nevada volcanic field: revised stratigraphic framework , 40-Ar/30-Ar geochronology, and implications for magmatism and extension. Geological Society of America Bulletin 106:1304-1318.

Schwartzmann, J. L., and R. D. Ohmart. 1978. Quantitative vegetational data of desert tortoise (*Gopherus agassizii*) habitat in the lower Sonoran Desert. Proceedings of the 1978 Symposium of the Desert Tortoise Council, April 1-3, 1978; Las Vegas, NV.

Severson, K. E. and A. L. Medina. 1983. Deer and elk habitat management in the southwest. Management Monograph No. 2. Society for Range Management. Denver, CO 64 pp.

Sheley, R. L. and J. K. Petroff. 1999. Biology and management of noxious rangeland weeds. Oregon State University Press. Corvallis, OR. 438 pp.

Sheley, R. L., J. K. Petroff, and M. M. Borman. 1999. Introduction. Pages 1-3, In: R. L. Sheley and J. K. Petroff (editors). Biology and Management of Noxious Rangeland Weeds. Oregon State University Press. Corvallis, Oregon. 438 pp.

St. Andre, G., H. A. Mooney, and R. D. Wright. 1965. The pinyon woodland zone in the White Mountains of California American Midland Naturalist 73:225-239.

Smith, A. D and D. M. Beale. 1980. Pronghorn antelope in Utah: Some research and observations. Utah Division of Wildlife Resources Publication No. 80-13. 88 pp.

Smith, N. S., P. R. Krausman, and R. E. Kirby. 1988. Desert bighorn sheep: A guide to selected management practices. Biological Report 88(35). United States Fish and Wildlife Service. 27 pp.

Smith, A. D. and J. C. Malechek. 1974. Nutritional quality of summer diets of pronghorn antelopes in Utah. Journal of Wildlife Management 38:792-798.

Steen, D. C., D. B. Hall, P. D. Greger, and C. A. Wills. 1997. Distribution of the Chuckwalla, western burrowing owl, and six bat species on the Nevada Test Site. Bechtel Nevada Ecological Services. Report DOE/NV/11718-149. 73 pp.

Stephenson, T. E., J. L. Holecheck, and C. B. Kuykendall. 1985. Drought effect on pronghorn and other ungulate diets. Journal of Wildlife Management 49:146-151.

Stewart, G. and A.C. Hull. 1949. Cheatgrass (*Bromus tectorum L.*) an ecologic intruder in southern Idaho. Ecology 30:58-74.

Sundstrom, C., W. G. Hepworth, and K. L. Diem. 1973. Abundance, distribution, and food habits of the pronghorn. A partial characterization of optimum pronghorn food habits. Bulletin 12. Wyoming Game and Fish Commission. 59 pp.

Tanner, W. W. and CP. Jorgensen. 1963. Reptiles of the Nevada Test Site. Brigham Young University Science Bulletin, Biology Series. 3(3):1-31.

Tausch, R. J. 1999. Historic pinyon and juniper woodland development. pp. 12-19. In: Proceedings: ecology and management of pinyon-juniper communities within the Interior West: 1997 September 15-18; Provo, UT Proc. RMS-P-9. Ogden, Utah.

Tausch, R, J. and R. S. Nowak. 1999. Fifty years of ecotone change between shrub and tree dominance in the Jack Springs pinyon Research Natural Area. pp. 71-77 In: Proceedings: Shrubland Ecotone; 1998 August 12-14; Ephraim, UT. Proc RMS-P-00. Ogden, Utah.

Tausch, R. J. and P. T. Tueller. 1990. Foliage biomass and cover relationships between tree-and shrub-dominated communities in pinyon-juniper woodlands. Great Basin Naturalist 50:121-124.

Tausch, R. J. and N. E. West.1995. Plant species composition patterns with differences in tree dominance on a southwestern Utah Pinon-juniper site. Pp 16-23: In: Proceedings: Desired future conditions for pinon-juniper Ecosystems. August 8-12, 1994. Flagstaff, Arizona. USDA Forest Service General Technical Report RM-258. Fort Collins, CO.

Tausch, R. J., J. c. Chambers, R. S. Blank, and R. S. Nowak. 1995. Differential establishment of perennial grass and cheatgrass following fire on an ungrazed sagebrush-juniper site. Pp. 252-257. In: Proceedings: wildland shrub and arid land restoration symposium; 1993 October 19-21; Las Vegas, NV. USFS General Technical Report INT-GTR-315.

Tausch, R. J., N. E. West, and A. A. Nabi. 1981. Tree age and dominance patterns in Great Basin pinyon-juniper woodlands. Journal of Range Management 34:259-264.

Tiedemann. A. R. 1987. Nutrient accumulations in pinyon-juniper ecosystems – managing for future site productivity. pp. 352-359. In: Proceedings: Pinyon-Juniper Conference. January 13-16, 1986, Reno, Nevada. USDA Forest Service General Technical Report INT-215.

Tingley, J. V., and K. G. Papke. 1987. Cactus Flat mineral inventory, Tonopah Test Range, Nye County, Nevada. Nevada Bureau of Mines and Geology unpublished draft report.

Tueller, P. T. 1979. Food habits and nutrition of mule deer on Nevada Ranges. Final Report Federal Aid in Wildlife Restoration Project W-48-5, Study 1. Job 2. Nevada Department of Fish and Game and Nevada Agricultural Experiment Station, University of Nevada Reno. 104 pp.

Tueller, P. T., C. D. Beeson, R. J. Tausch, N. E. West, and K. H. Rea. 1979. Pinyon-juniper woodlands of the Great Basin: distribution, flora, vegetal cover. USFS Research Paper INT-229.

Tueller, P. T. and L. A. Monroe, 1975. Management guidelines for selected deer habitats in Nevada. Publication No. R 104. Agricultural Experiment Station, University of Nevada Reno. 185 pp.

Urness, P. J. And C. Y. McCulloch. 1973. Deer nutrition in Arizona chaparral and desert habitats. Part II: chemical analysis and in vitro digestibility of Seasonal Deer Forages. Spec. Rep. E. Federal Aid in Wildlife Restoration Act, Proj. W-78-R.

USDA, 1987. Major Land Resource Area 29, Nevada site descriptions. Southern Basin and Range. Nevada State Office. Reno, Nevada.

USAF, 1985. Draft environmental impact statement. Groom Mountain Range, Lincoln County, Nevada. Nellis Air Force Base, Nevada.

USAF, 1994a..Environmental assessment for supersonic flight over the Nellis Range complex, Nellis Air Force Base, Nevada.

USAF, 1996a. Surface soil sampling report for ten representative Nellis Air Force Range bombing targets, Nellis Air Force Base, Nevada.

USAF, 1997a. Integrated natural resources management plan, Nellis Air Force Base/Nellis Air Force Range. 99th Air Base Wing, Environmental Management Directorate, Nellis Air Force Base, Nevada.

USAF, 1997b. Nellis Air Force Range wetlands survey report, appendix C. 99th Air Base Wing, Environmental Management Directorate, Natural Resources, Nellis Air Force Base, Nevada. March, 1997.

USAF, 1997c. Flood plain inventory report, Neliis Air Force Range, Nevada. Nellis Air Force Base, June.

USAF. 1997d. Mineral and energy resources assessment of the Nellis Air Force Range, V.1 & V.2. Final Report. Prepared by Nevada Bureau of Mines and Geology and PRC Mariah and Assoc, Inc., Air Combat Command. November 1997

USAF, 1998a.. Final water requirements study of the Nellis Air Force Range, US Depart of the Air Force, 99th ABW, Nellis Air Force Base, September, 1998.

USAF, 1998b. Draft legislative environmental impact statement renewal of the Nellis Air Force Range land withdrawal, US Depart of the Air Force, 99th ABW, Nellis Air Force Base, September 1998.

USAF, 1999. Renewal of the Nellis Air Force Range land withdrawal. Legislative environmental impact statement. Volume 1. U.S. Department of the Air Force, 99th ABW, Nellis Air Force Base. March.

USAF, 2000. Hazardous waste management plan; Nellis Air Force Base plan 12. Nellis Air Force Base, NV. November

Unknown 1964. 223. Astragalus musimonum. Memoirs of the New York Botanical Garden. 13:708-709.

USFWS, 1974a. Desert Tortoise (Mojave Population) Recovery Plan. U.S. Fish and Wildlife Service, Portland, OR.

USFWS. 1974b. Mammals, amphibians and reptiles of the Desert National Wildlife Range, Nevada. Pamphlet RF-1351500-8-February, 1974.

Valdez, R. and P. R. Krausman. 1999. Mountain sheep of North America. University of Arizona Press. 333 pp.

Vale, T. R. 1974. Sagebrush conversion projects: an element of contemporary environmental change in the western United States. Biological Conservation 6:274-284.

Van Devender, T. R. and W. Geoffrey Spaulding. 1979. Development of vegetation and climate in the southwestern United States. Science 204:701-710.

Van Dyke, W. A., A. Sands, J. Yoakum, A. Polenz, and J. Blaisdell. 1983. Wildlife habitats in managed rangelands – the Great Basin of southeastern Oregon. USDA Forest Service, Pacific Northwest Experiment Station. General Technical Report

Watkins, L. C. 1977. *Euderma maculatum*. Mammalian Species 77:1-4.

Wehausen, J. D. 1996. Effects of mountain lion predation on bighorn sheep in the Sierra Nevada and Granite Mountains of California. Wildlife Society Bulletin 24:471-479.

Weisenberger, M. W., P. R. Krausman, M. C. Wallace, D. W. DeYoung, and O. E. Manghan. 1996. Effects of simulated jet aircraft noise on heart rate and behavior of desert ungulates. Journal of Wildlife Management 60:52-61.

West, N. E. 1983. Great Basin – Colorado Plateau sagebrush semi-desert. pp. 331-349. In: N. E. West (ed). Ecosystems of the World 5. Temperate Deserts and Semi-Deserts. Elsevier, New York. 522 pp.

West, N. E., R. J. Tausch, K. H. Rea, and P. T. Tueller. 1978. Phytogoegraphical variation within juniper-pinyon woodlands of the Great Basin. Great Basin Naturalist Memoirs 2:119-136.

West, N. E., R. J. Tausch, and P. T. Tueller, 1998. A management-oriented classification of pinyon-juniper woodlands of the Great Basin. USDA Forest Service, General Technical Report RMS-GTR-12. 42 pp.

Wilson, R. W. and R. D. Stager. 1989. Association between soils and desert tortoise population densities and distribution, Piute Valley, Nevada. Unpublished Manuscript. U. S. Department of the Interior, Bureau of Land Management, Las Vegas, Nevada. 17 pp.

Wilson, L. O., J. Blaisdell, G. Welsh, R. Weaver, R. Brigham, W. Kelly, J. Yoakum, M. Hinkes, J. Turner, and J. DeForge. 1980. Desert sheep habitat requirements and management recommendations. Desert Bighorn Council Transactions 24:1-7

Woodbury, A. M. and R. Hardy. 1948. Studies of the desert tortoise (*Gopherus agassizii*). Ecological Monographs 18:145-200.

Yoakum, J. 1990. Food habits of the pronghorn. Pronghorn Antelope Workshop Proceedings 14:102-111.

Young, J. A. and R. A. Evans. 1975. Germinability of seed reserves in a big sagebrush community Weed Science 23:358-364.
Young, J. A. and R. A. Evans. 1978. Population dynamics after wildfires in sagebrush grasslands. Journal of Range Management 31:283-289.
Young, J. A., R. A. Evans, and R. E. Eckert, Jr. 1969a. Population dynamics of Downy Brome. Weed Science 17:20-26.
Young, J. A., R. A. Evans, and R. E. Eckert, Jr. 1969b.Emergence of Medusahead and other grasses from four seeding depths. Weed Science 17:376-379.
Young, J. A. R. A. Evans, and J. Major. 1972. Alien plants in the Great Basin. Journal of Range Management 25:194-201.
Young, J. A., R. A. Evans, and R. A. Weaver. 1976. Estimating potential downy brome competition after wildfires. Journal of Range Management 29:322-325.
Young, J. A., C. D. Clements, and R. B. Blank. 1997. Influence of nitrogen on antelope bitterbrush seedling establishment. Journal of Range Management 50:536-540.
Young, J. A. and R. A. Evans. 1981. Demography and fire history of a western juniper stand. Journal of Range Management 34:501-505

APPENDICES

THIS PAGE DELIBERATELY LEFT BLANK

APPENDIX A

Legal Description for NTTR BLM Planning Area

Table A-1. Legal Description for NTTR, BLM Planning Area.

Mount Diablo Meridian

Tps. 1 to 4 S., R. 44 E.
T. 5 S., R. 44 E., (unsurveyed)
Secs. 1 and 2;
Secs. 10 to 16, inclusive;
Secs. 20 to 36, inclusive.
T. 6 S., R., 44 E., (unsurveyed)
Secs. 1 to 6, inclusive;
Secs. 8 to 17, inclusive;
Secs. 21 to 27, inclusive;
Secs. 34 to 36, inclusive.
T. 7 S., R. 44 E., (unsurveyed)
Secs. 1 and 2;
Secs. 11 to 13, inclusive.
T. 1 to 4 S., R. 45 E.,
Tps. 5 and 6, S., R. 45 E., (unsurveyed)
T. 7 S., R. 45 E., (unsurveyed)
Secs. 1 to 30, inclusive;
Secs. 32 to 36, inclusive.
T. 8 S., R. 45 E., (unsurveyed)
Secs. 1 to 4, inclusive;
Secs. 10 to 14, inclusive;
Secs. 24 and 25.
Tps. 1 and 2 S., R. 46 E.,
Tps. 3 to 8 S., R. 46 E., (unsurveyed)
T. 9 S., R. 46 E., (unsurveyed)
Secs. 1 to 5, inclusive;
Secs. 9 to 15, inclusive;
Secs. 23 and 24.
Tps. 1 and 2 S., R. 47 E.
Tps. 3 to 8 S., R. 47 E., (unsurveyed)
T. 9 S., R. 47 E., (unsurveyed)
Secs. 1 to 30, inclusive;
Secs. 33 to 36, inclusive.
T. 10 S., R. 47 E., (unsurveyed)
Secs. 1, 2, and 12.
Tps. 1 and 2 S., R. 48 E.
Tps. 3 to 5 S., R. 48 E. (unsurveyed)
T. 6 S., R. 48 E., (unsurveyed)
Secs. 1 to 34, inclusive.
T. 7 S., R. 48 E., (unsurveyed)
Secs. 3 to 10, inclusive;
Secs. 15 to 23, inclusive;
Secs. 25 to 36, inclusive.
Tps. 8 and 9 S., R. 48 E. (unsurveyed)
T. 10 S., R. 48 E., (unsurveyed)
Secs. 1 to 17, inclusive;
Secs 21 to 26, inclusive;
Sec. 36.
Tps. 1 and 2 S., R. 49 E.
Tps. 3 to 5 S., R. 49 E. (unsurveyed)

Mount Diablo Meridian

T. 6 S., R. 49 E., (unsurveyed)
Secs. 1 to 30, inclusive;
Secs. 31 to 36, inclusive.
T. 7 S., R. 49 E., (unsurveyed)
Secs. 1 to 5, inclusive.
T. 8 S., R. 49 E., (unsurveyed)
Secs. 6 to 8, inclusive;
Secs. 17 to 21, inclusive;
Secs. 28 to 34.
T. 9 S., R. 49 E., (unsurveyed)
Secs. 3 to 11, inclusive;
Secs. 14 to 36, inclusive.
Tps. 10 to 12 S., R. 49 E. (unsurveyed)
Tps. 1 to 5 S., R. 50 E. (unsurveyed)
T. 6 S., R. 50 E., (unsurveyed)
Secs. 1 to 32, inclusive.
Tps. 2 to 5 S., R. 51 E. (unsurveyed)
T. 6 S., R. 51 E. (unsurveyed)
Secs. 1 to 30, inclusive;
Secs. 34 to 36, inclusive.
T. 7 S., R. 51 E., (unsurveyed)
Sec. 1.
Tps. 3 and 4 S., R. 51½ E. (unsurveyed)
Tps. 3 to 6 S., R. 52 E. (unsurveyed)
T. 7 S., R. 52 E., (unsurveyed)
Secs. 1 to 16, inclusive;
Secs. 21 to 28, inclusive;
Secs. 33 to 36, inclusive.
T. 8 S., R. 52 E., (unsurveyed)
Secs. 1 to 4, inclusive;
Secs. 9 to 12, excepting those portions withdrawn by PLO No. 805.
Tps. 3 and 4 S., R. 53 E.
Tps. 5 to 7 S., R. 53 E. (unsurveyed)
T. 8 S., R. 53 E., (unsurveyed)
Secs. 1 to 6, inclusive;
Secs. 7 to 12, except those portions withdrawn by PLO No. 805.
T. 3 S., R. 54 E.,
Secs. 4 to 9, inclusive;
Secs. 16 to 21, inclusive;
Secs. 28 to 33, inclusive.
T. 4 S., R. 54 E.,
Secs. 4 to 9, inclusive;
Secs. 16 to 21, inclusive;
Secs. 28 to 33, inclusive.
Tps. 5 to 7 S, R. 54 E. (unsurveyed)
T. 8 S., R. 54 E., (unsurveyed)
Secs. 1 to 6 inclsv, 12, 13, 24, 25, and 36;
Secs. 7 to 11, 14, 23, 26, and 35 excepting those portions withdrawn by PLO No. 805.

Mount Diablo Meridian

T. 9 S., R. 54 E., (unsurveyed)
Secs. 1, 12, 13, 24, 25, and 36;
Secs. 2, 11, 14, 23, 26, and 35 excepting those portions withdrawn by PLO No. 805.
T. 10 S., R. 54 E., (unsurveyed)
Secs. 1, 12, 13, 24, 25, and 36;
Secs. 2, 11, 14, 23, 26, and 35 excepting those portions withdrawn by PLO No.
T. 11 S., R. 54 E. (unsurveyed)
Secs. 1, 12, 13, 24, 25, and 36;
Secs. 2, 11, 14, 23, 26, and 35 excepting those portions withdrawn by PLO No. 805.
T. 12 S., R. 54 E., (unsurveyed)
Secs. 1, 12, 13, 24, 25, and 36;
Secs. 2, 11, 14, 23, 26, and 35 excepting those portions withdrawn by PLO No. 805.
T. 13 S., R. 54 E., (unsurveyed)
Secs. 10 to 15, inclusive;
Secs. 22 to 27, inclusive;
Secs. 34 to 36, inclusive;

Secs. 9, 16, 21, 28, and 33 excepting those portions withdrawn by PLO No. 805.
T. 14 S., R. 54 E., (unsurveyed)
Secs. 1 to 3, inclusive;
Secs. 10 to 15, inclusive;
Secs. 22 to 27, inclusive;
Secs. 34 to 36, inclusive;
Secs. 4, 9, 16, 21, 28, and 33 excepting those portions withdrawn by PLO No. 805.
Tps. 5 to 14 S., R. 55 E. (unsurveyed)
T. 5 S., R. 55½ E. (unsurveyed),
Sec. 6, excluding mineral patent;
Secs. 7 and 8;
Secs. 16 to 21, inclusive;
Secs. 28 to 33, inclusive.
T. 6 S., R. 55½ E. (unsurveyed)
T. 7 S., R. 55½ E., (unsurveyed)
excluding mineral patents.
Tps. 8 to 15 S., R. 55½ E. (unsurveyed)
T. 16 S., R. 55½ E.,
Sec. 1, N½;
Sec. 2, N½.
T. 5 S., R. 56 E., (unsurveyed)
Sec. 19;
Sec. 20, excluding mineral patent;
Secs. 27 to 35, inclusive.
T. 6 S., R. 56 E., (unsurveyed)
Secs. 2 to 11, inclusive;
Secs. 14 to 23, inclusive;
Secs. 25 to 36, inclusive.

Mount Diablo Meridian

T. 7 S., R. 56 E., (unsurveyed)
Secs. 1 to 11, inclusive;
Secs. 13, W½;
Secs. 14 to 23, inclusive;
Sec. 24, NW¼;
Secs. 26 to 35, inclusive.
Tps. 8 to 15 S., R. 56 E. (unsurveyed)
T. 16 S., R. 56 E.,
Secs. 1 and 2;
Sec. 3, lots 5 to 9, inclusive, and E½;
Sec. 4, lots 5 to 8, inclusive;
Sec. 5, lots 5 to 9, inclusive, NW¼, and W½NE¼;
Sec. 6, lots 8 and 9, NE¼, and W½;
Sec. 8, lot 1;
Sec. 9, lot 1;
Tracts 38, 39, 40, 41, and 42 A, B, C.
T. 6 S., R. 57 E.
Sec. 30, W½;
Sec. 31.
T. 7 S., R. 57 E.,
Sec. 6.
Tps. 8 to 15 S., R. 57 E. (unsurveyed)
T. 16 S., R. 57 E. (unsurveyed)
Secs. 1 to 6, inclusive;
Sec. 7, NE¼;
Secs. 8 to 16, inclusive;
Sec. 17, NE¼;
Sec. 20, SE¼SW¼ and S½SE¼;
Sec. 21, NE¼ and SW¼SW¼;
Secs. 22 to 26, inclusive;
Sec. 27, NE¼;
Sec. 28, NW¼NW¼;
Sec. 29, N½NE¼ and NE¼NW¼;
Sec. 35, NE¼;
Sec. 36.
Tps. 8 to 15 S., R. 58 E. (unsurveyed)
T. 16 S., R. 58 E., (unsurveyed)
Secs. 1 to 10, inclusive;
Secs. 15 to 22, inclusive;
Secs. 27 to 34, inclusive.
T. 17 S., R. 58 E.,
Secs. 1 to 4, inclusive;
Sec. 5, NE¼;
Sec. 9, NE¼;
Sec. 10, N½, N½SW¼, SE¼SW¼, and SE¼;
Secs. 11 and 12;
Sec. 13, NW¼;
Sec. 14, N½, NE¼SW¼, and SE¼;
Sec. 15, NE¼NE¼.
Tps. 8 to 14 S., R. 59 E. (unsurveyed)

THIS PAGE DELIBERATELY LEFT BLANK

APPENDIX B

Historic Mineral Production from Mining Districts on the NTTR

Table B-1. Total mineral production by mining district. on the NTTR

DISTRICT	ORE tons	GOLD Oz	SILVER Oz	COPPER Pounds	LEAD Pounds	ZINC Pounds	YEARS PRODUCED	COMMENTS
Antelope Springs	328	157	5,4024	275	454		1912-17, '26, '39	
Cactus Springs	200	15	3,147				1909-10, '15-16, '20,'27, '40-41	
Clarkdale	316	160	398				1932-33, '36-38, '40	Under Bullfrog '30s; Beatty, '40
Gold Crater	188	82	2,722		4,500		1913, '16, '39, '49, '53	
Gold Reed	335	217	475				1910-12, '21, '27, '41	
Groom	34,484	45	14,5279	72,421	10,425,430	39,100	1915-18, '22-31, '33-38, '42-56	
Jamestown	1	4					1908	$78 per ton
Mellan	20	3	2				1936	Under Tonopah, '35; Kawich,'36
Oak Springs	26	10	667	3,832			1917, '51	
Papoose	458	1	3029	400	301,673			
Rainstorm	39	5	918	128	42,741		1933, '51	Under Groom
Silverbow	3,524	1,346	9,5976				1906-14, '20-23, '29-36, '40-47, '55	
Southeastern	31		352	1,400	2,700		1940, '47	Under Groom, 1947
Stonewall*	38	16	1,165				1910, '15-16	
Tolicha	991	1,345	2,409				1923, '29-36, '40	
Trappmans	1	1	130				1908	
Wilsons	15		527	105	993		1933	
TOTAL	40,995	3,407	311,220	78,561	10,778,491	39,100		

*Production listed for Silverbow and Stonewall districts may have come in part from mines located outside Nellis Range boundaries. Production from other districts came entirely from mines within range boundaries.

APPENDIX C

NTTR 2001 Hydrologic Data:

Locations of Springs, Reservoirs, and Wells

and

Water Chemistry for Springs and Wells

Field Reconnaissance and Analytical Chemistry Data for Water Sources on the Nevada Test and Training Range

During the period 5 May through 21 Dec 2000, a field reconnaissance of water sources on the Nevada Test and Training Range (NTTR) was undertaken. The reconnaissance was designed to provide information to support natural resource management planning by the Bureau of Land Management as required by Congressional re-authorization of the NTTR land withdrawal for Air Force use. The reconnaissance effort was accomplished by personnel of the Desert Research Institute from offices in Reno and Las Vegas, Nevada.

Preliminary location data for springs, wells, reservoirs, and flooded mine shafts were obtained from the following sources and from consultation with personnel of the NTTR resource management offices and the USGS.

- Draft Legislative Environmental Impact Statement, Renewal of the Nellis Air Force Range Land Withdrawal; USAF, March 1999.
- Water Requirements Study of the Nellis Air Force Range; USAF, September 1998.
- Water right permits and applications on file with the Nevada Division of Water Resources.
- US Geological Survey topographic maps, 1:24,000 and 1:100,000 scales.
- Hydrogeologic and Hydrochemical Framework, South-Central Great Basin, Nevada-California, with Special Reference to the Nevada Test Site; I. J. Winograd and W. Thordarson, 1975.
- Draft Environmental Impact Statement, Groom Mountain Range; USAF, October 1975.
- Range Management Office, Nellis AFB, Geographic Information System Office.

Water source locations were visited, location coordinates were determined using Global Positioning System instrumentation; and, where adequate flow was observed, flow rate was determined, field chemistry parameters were measured, and water samples were collected. Field parameters included temperature, pH, electrical conductivity, and dissolved oxygen. Water samples were analyzed to determine concentration of major inorganic, trace element, and selected isotopic constituents.

Seven tables exhibiting data obtained during the water source reconnaissance are compiled. Tables B-1 (springs), B-2 (reservoirs), and B-3 (wells) contain location locations coordinates determined during field reconnaissance and as reported in various published and unpublished documents. Field chemistry parameters and discharge measurement for water sources assessed during field reconnaissance and presented in Table C-4.. Major ion chemistry data for those water sources sampled are presented in Table C-5. Table C-6 exhibits selected trace element data for sampled water sources. Table C-7 contains selected isotopic chemistry data for sampled water sources. For completeness, available historic chemistry data have been incorporated in Tables B-5, B-6 and B-7.

Table C-1. Locations for springs on the NTTR as determined during field reconnaissance and reported in various publications.

Water Source Name	USGS[1]	NTTR Field Recon. Latitude	Longitude	USAF, 1997[2] Latitude	Longitude	ID #	USAF, 1998[3] / USAF, 1998b[4] Township Range sec	Ref. #[6]	RMO GIS data base[5] UTM north	UTM east	SW #	USAF, 1998b UTM north	UTM east	Map #
Springs														
Goldfield Hills														
Tognoni Spring	m	off range, not visited[7]		not listed[8]			2S 43E s28 NE SW	77	4176794.25	486637.062	59	not listed		
Wildhorse Spring	m	37 43.483	117 05.354	37 43.48	117 05.32	1	2S 44E s31 NW SE	4	4175277	492191.469	4	4173999.43	492059.91	4
Cane (Willow) Spring	m	off range, not visited		not listed			2S 43E s36 SW SW	76	4174293	489864.656	58	not listed		
unnamed	m	off range, not visited		not listed			not listed		not listed			not listed		
unnamed (e side of Goldfield Hills)	nm	37 41.863	117 03.786	not listed			not listed		not listed			not listed		
Cactus Range														
unnamed (w of Cactus Peak)	nm	not found[9]		not listed			not listed		not listed			4180209.75	510701.1	1
unnamed (sw of Cactus Peak)	nm	not found		not listed			2S 45E s13 SE NW	1	4179872.25	511082.688	1	not listed		
unnamed (s of Cactus Peak)	nm	37 44.972	116 51.848	not listed			not listed		not listed			not listed		
Stealth Spring	nm	37 45.398	116 50.362	37 45.40	116 50.42	5	2S 46E s22	56	4178829.5	514069.312	92	4178793.68	514603.93	56
Alkali Spring	nm	37 42.429	116 51.366	37 42.31	116 53.65	3	3S 46E s5 NW SW	5, 6	4173305.75	509328.875	5, 6	4174331.91	508762.86	5, 6
Sleeping Column Spring	nm	not visited		37 42.43	116 51.42	4	not listed		not listed			4173295.91	512535.9	63
Cactus Spring	m	37 43.270	116 49.005	37 43.31	116 49.00	6, 7, 8	2S 46E s34 NW SE	16, 17	4174980.5	516156.844	16, 17	4174752.69	517159.77	16, 17
Urania Mine Seep	nm	37 41.831	116 49.211	37 41.81	116 49.18	9	3S 46E s10	57	4172206.5	515892.594	82	4171851.47	515225.63	57
unnamed (s of Urania Mine)	m	37 41.331	116 48.898	not listed			not listed		not listed			not listed		
Antelope Spring	m	37 37.179	116 43.506	37 37.17	116 43.49	10	4S 47E s4 NW SW	15	4163628.75	524292.875	15	4164183.95	523894.75	15
above Antelope Spring	nm	37 37.076	116 43.742	not listed			not listed		not listed			not listed		
south of Antelope Spring	m	37 36.950	116 43.634	not listed			not listed		not listed			not listed		
Cactus Flat														
Fork Spring	nm	not found		not listed			1S 47E s22 NW NW	68	4188115.25	529329.5	50	not listed		
Kawich Range														
Silverbow Canyon (Breen Ck. Marsh)	nm	37 55.058	116 28.134	not listed			1N 49E s23 SW NW	83	4196144.5	546222.25	66	not listed		
Stinking Spring	m	37 53.662	116 31.557	not listed			1N 49E s6 NW SW	67	4194177	541397.312	49	not listed		
Silverbow (Breen) Creek	nm	location not determined[10]		not listed			1S 49E s4 SE NW	19	4192252.75	544704.938	19	4192930.07	543526.09	19
Silverbow Spring	nm	location not determined		not listed			1S 49E s9 NE NW	18	4192061.5	543533.688	91	4191393.51	543560.23	18
	nm								4191658.75	544268.625	18			
Tramp Spring	m	37 53.265	116 22.093	not listed			not listed		not listed			not listed		
Thunderbird Spring	m	37 52.535	116 24.567	37 52.54	116 24.57	15	1S 50E s8	60	4192172.25	551936.75	94	4190949.61	553052.79	60
unnamed (se of Nixon Peak)	m	37 52.296	116 26.593	not listed			not listed		not listed			not listed		
Blackhawk Spring	nm	not visited		37 52.44	116 24.02	18	not listed		not listed			not available		79
Sandeen Spring	nm	37 51.909	116 23.778	not listed			1S 50E s9	59	4191750.5	553502.938	93	4190266.69	552028.41	59
Phantom Spring	nm	not found		37 52.15	116 23.10	16	1S 50E s14	58	4191847.25	554088.75	95	4189788.65	556501.52	58
George's Water	m	37 51.589	116 20.977	37 51.90	116 20.90	17	1S 50E s11 SE SW	8 / 16[11]	not listed			4191312.29	556971.13	67
* George's Water pipeline trough[12]	nm	37 51.582	116 16.237	not listed			not listed		not listed			not listed		
* corral below George's Water	nm	37 53.660	116 15.312	not listed			not listed		not listed			not listed		
* corral at Willow Witch Well	nm	37 50.495	116 12.520	not listed			not listed		not listed			not listed		
Tunnel Spring	m	37 47.395	116 23.120	37 47.15	116 23.89	19	2S 50E s4 SE SE	73	4182131.25	553003.25	55	4186576.96	549196.06	72
Corral Spring	m	37 47.056	116 23.032	37 47.11	116 22.87	20	1S 50E s8 NW NE	74	4182172	554495.125	56	not listed		
* Corral Spring, north	nm	see above		not listed			not listed		not listed			4182754.6	554145.46	61
* Corral Spring, south	nm	see above		not listed			not listed		not listed			4181764.37	554111.31	62
* Coral (Corral) Spring	nm	see above		not listed			2S 50E s9 NE NE	62	4181934.75	551145.5	90	not listed		
Harley Spring	nm	not visited		37 46.20	116 22.11	21	not listed		not listed			4182762.29	556183.39	78
Jarboe Spring	nm[13]	not found		not listed			not listed		not listed			not listed		
unnamed (w of Jarboe Spring)	nm[13]	not visited		not listed			not listed		not listed			not listed		

Table C-1(cont.). Locations for springs on the NTTR as determined during field reconnaissance and reported in various publications (continued).

Water Source Name	USGS[1]	NTTR Field Recon. Latitude	Longitude	USAF, 1997[2] Latitude	Longitude	ID #	USAF, 1998[3] / USAF, 1998b[4] Township Range sec	Ref. #[6]	RMO GIS data base[5] UTM north	UTM east	SW #	USAF, 1998b UTM north	UTM east	Map #
Springs (continued)														
Kawich Range (continued)														
Sumner (Summer) Spring	m	37 46.369	116 17.458	37 46.39	116 17.42	23	2S 51E s16 NW NW	50, 51	4180872.75	562503.875	45, 46	4181866.81	562340.47	50, 51
* corral below Cedar	nm	37 45.696	116 10.694	not listed			not listed		not listed			not listed		
* Cedar Ranch trough	nm	37 45.185	116 07.755	not listed			not listed		not listed			not listed		
Log Spring	m	not found		37 45.49	116 22.16	22	2S 50E s23	55	4179158.5	555542.625	88	4179203.43	555647.87	55
Cedar Spring	m	37 45.081	116 16.378	37 45.05	116 16.37	28	2S 51E s22 SW NW	52, 53	4178418.75	564063.688	47, 48	4179169.28	563501.43	52, 53
Rose Spring	m	37 44.776	116 19.877	37 44.47	116 19.53	26	2S 50E s24 SE SE	54	4177305.5	559422.5	14, 87	4177940.03	557696.63	54
* Rose Spring trough (pond)	nm	37 44.355	116 25.033	37 43.39	116 23.87	25	not listed		not listed			4177009.39	552320.93	77
* Wild Horse Ranch trough	nm	37 42.409	116 24.066	not listed			not listed		not listed			not listed		
Cedar Wells	m	37 42.007	116 16.085	37 42.09	116 16.40	29	not listed		not listed			4172821.13	563985.57	74
Wild Horse Draw Spring	nm[13]	not found		not listed			not listed		not listed			not listed		
Granite Spring	nm	37 36.831	116 20.050	not listed			4S 50E s12 NE NE	65	4163216.25	558837	89	not listed		
Cedar Pass Spring	nm	not visited		37 43.58	116 18.38	27	not listed		not listed			4175524.59	561043.57	73
Kawich Valley														
unnamed spring	nm	not found		37 30.48	116 10.05	46	not listed		not listed			not listed		
Stmonewall Mountain														
Stonewall Spring	m	37 32.436	117 03.862	not listed			4S 44E s32 SE SE	2	4154780.5	495141.125	2	4155932.42	492225.43	2
unnamed, west of Stonewall Spring	m	37 31.748	117 04.570	not listed			not listed		not listed			not listed		
Jerome Spring	m	not visited		37 29.98	117 03.06	30	5S 44E s16 SE SW	3	4150311.75	495482.438	3	4150619.79	495465.76	3
Belted Range														
Cliff Spring, Belted Range	m	37 30.677	116 05.278	37 30.68	116 05.28	40	5S 52E s14 NW NE	24	4151995.75	580595.25	24, 60, 78	4151791	580606	24
unnamed (above Cliff Spring, Belted R.)	m	37 30.691	116 04.974	not listed			5S 53E s8 SE SE	23	not listed			not listed		
unnamed (wnw of Cliff Spring, Belted R.)	m	37 30.825	116 05.682	not listed			5S 53E s7 NW NE	22	not listed			4152713.3	580145.01	23
Shirley Spring	nm	not found		not listed			6S 52E s16 NE SE	79	4141417	573151	62	not listed		
Indian Spring,	m	37 26.514	116 06.044	37 26.50	116 06.04	50	6S 52E s11 NW NW	30, 31	4143544.5	579325.688	63	4144054	579558	30, 31
	nm								4140731	579057.312	100, 101			
unnamed (n of Indian Spring, Belted R.)	m	37 28.879	116 05.737	not listed			not listed		not listed			not listed		
Falcon Spring	nm	not visited		37 30.83	116 05.68	41	not listed		not listed			4148287.79	576850.38	76
Wildcat Spring	nm	not found		37 28.07	116 06.92	49	5S 53E s31 SW SE	28	4147134	578234.875	27	4143130	580987	28
Pony Spring	nm	not found		not listed			5S 52E s26 NW SW	82	4148280	575522.188	65	not listed		
Horse Spring	nm	not found		37 30.33	116 04.17	44	5S 52E s1 NE NE	21	4151364.25	582246.875	21	4154739.92	577962.5	21
Gold Spring	m	37 27.400	116 03.633	37 27.25	116 04.38	53	6S 52E s1 SW SW	29	4145660	582008.312	28	4145152.43	576988.16	29
unnamed (sse of Belted Peak)	m	not visited		not listed			not listed		not listed			not listed		
unnamed	nm	not visited		37 29.58	116 03.84	42	not listed		4149982.5	582751.562	22	not listed		
unnamed	nm	not visited		37 29.21	116 02.75	43	not listed		4149320.5	584354.875	23	not listed		
Johnnie's Water (Spring)	nm	not visited		37 26.20	116 04.40	52	6S 52E s12 SE SE	32	4143718.25	581978.188	29	4145746	582663	32
	m								4143339.75	581096.875	85			
unnamed (ssw of Belted Peak)	nm	not found		not listed			not listed		not listed			4153297.9	578508.13	22
Groom Range														
unnamed (watertank)	m	not visited		not listed			not listed		not listed			not listed		
Old Tikapoo	m	37 32.092	115 44.642	not listed			not listed		not listed			4154800	610955	105
April Fool	m	37 31.872	115 44.292	not listed			not listed		not listed			4154410	611485	106
Rosebud	nm	37 29.725	115 45.825	not listed			not listed		not listed			4150340	609270	100
Sharp m	37 31.683	115 44.817	not listed			not listed		not listed			4154025	610705	104	

Table C-1 (cont.). Locations for springs on the NTTR as determined during field reconnaissance and reported in various publications (continued).

Water Source Name	USGS[1]	NTTR Field Recon. Latitude	NTTR Field Recon. Longitude	USAF, 1997[2] Latitude	USAF, 1997[2] Longitude	ID #	USAF, 1998[3] / USAF, 1998b[4] Township Range sec	Ref. #[6]	RMO GIS data base[5] UTM north	RMO GIS data base[5] UTM east	SW #	USAF, 1998b UTM north	USAF, 1998b UTM east	Map #
Springs (continued)														
Groom Range (continued)														
New Tikapoo	m	37 31.567	115 44.383	not listed			not listed		not listed			4153817	611350	107
Savio nm	37 29.500	115 42.300	not listed			not listed		not listed			4149990	614450	108	
Lick	nm	37 29.308	115 41.925	not listed			not listed		not listed			4149655	615055	109
Rabbit Brush	nm	37 28.967	115 41.375	not listed			not listed		not listed			4149040	615870	110
Naquinta Spring	nm	37 27.687	115 44.932	not listed			not listed		not listed			not listed		
Pine	m	37 26.743	115 45.360	not listed			not listed		not listed			4144828	610007	101
Indian Spring (Groom Range)	m	37 26.322	115 45.371	not listed			5S 56E s2 SE SE	92	4155266.5	619344.438	73	4144005	609990	102
Quail Spring	nm	37 26.033	115 41.275	not listed			6S 56E s9 SW SE	47	4144525.75	615768.062	43	4143615	616062	47
Alum nm	not found		not listed			not listed		not listed			not listed			
Cliff Spring, Groom Range	nm	37 25.517	115 44.900	not listed			5S 56E s29 SW NW	98	not listed			4142572	610725	112
Cattle Spring	m	37 24.850	115 47.200	not listed			5S 56E s21 NE SW	97	4141656.25	611500.188	77	4141300	607380	103
Rock Spring (Tikaboo V.)	Nm	37 24.242	115 42.725	not listed			6S 56E s29 NW NE	37	4140728.25	613991.188	42	4140250	613973	37
Cane Spring (Groom Range)	nm	37 20.250	115 45.025	not listed			9S 56E s17 NW SW	39	4133465	610265.75	80	4132840	610697	39
	nm						7S 55E s25 SW SE	100	4120493.5	594479.812	35			
Miners Spring	nm	37 19.808	115 47.033	not listed			7S 55E s25	88	4129192.25	605904.562	69	4132025	607715	113
Disappointment Spring	nm	37 19.592	115 47.392	not listed			7S 55E s25	89	4129192.25	605904.562	70	4131580	607196	114
Chalk Mountain														
Beck Spring	nm	location not determined		not listed			5S 54E s2 NE NE	49	4155922.25	595699.688	44	41549999	597397	49
Chalk Spring	nm	not found		not listed			5S 54E s5 SE SW	36	4154060	589564.188	33	4152713.3	590979.66	36
White Blotch Spring	m	37 31.633	115 56.025	not listed			not listed		not listed			not available		115
Jumbled Hills														
Summit Spring	nm	37 15.900	115 38.175	not listed			not listed		not listed			not listed		
Mount Irish														
Tule Spring	nm	off range, not visited		not listed			4S 58E s27 NW SE	87	4158660.25	635594.562	68	not listed		
Tolicha Peak														
Monte Cristo Spring	m	37 18.254	116 50.059	37 18.27	116 50.10	33	7S 46E s28 SW SW	7	4128659	514622.406	7	4127964.2	514607.86	7
Rock Spring	nm	not found		37 17.86	116 48.33	35	7S 46E s26 SW SE	8	4127924.5	517233.062	8	4127457.11	518210.84	8
Trapman Spring	nm	37 17.435	116 51.221	37 17.65	116 50.79	34	7S 46E s32 SE NW	9	4127517	513614.812	9	4126629.76	513300.11	9
Tule George Spring	nm	not found		37 16.90	116 48.84	36	8S 46E s3 SE NW	10	4126135.5	516498.188	10	4123720.69	516716.27	10
Pahute Mesa														
Larry's Seep	nm	not found		37 22.60	116 43.30	31	7S 47E s8 NE NW	12	4136695	524642.562	12	4135410.35	522801.3	12
Black Rock Spring	nm	off range (NTS), not visited		not listed			7S 51E s22 SE NW	33	4128671.5	563513.188	30	4132378.09	564027.38	33
Kihibab Spring	nm	off range (NTS), not visited		not listed			7S 51E s35 NE NE	34	4127214.5	566449.25	31	4127898.63	566543.25	34
Live Oak Spring	nm	off range (NTS), not visited		not listed			8S 51.5E s7 SE SE	81	4116984.25	570406.25	64	not listed		
Quartz Mountain														
Pillar Spring	nm	37 15.882	116 41.477	37 16.09	116 41.38	37	8S 47E s10 NE NE	11	4124654.25	527510.312	11	4126442.94	524375.94	11
unnamed seep (ne side of Quartz Mt.)	nm	location not determined		not listed			not listed		not listed			not listed		
Black Mountain														
unnamed seep (n side Black Mt)	nm	location not determined		not listed			not listed		not listed			not listed		

Table C-1(cont.). Locations for springs on the NTTR as determined during field reconnaissance and reported in various publications (continued).

Water Source Name	USGS[1]	NTTR Field Recon. Latitude	Longitude	USAF, 1997[2] Latitude	Longitude	ID #	USAF, 1998[3] / USAF, 1998b[4] Township Range sec	Ref. #[6]	RMO GIS data base[5] UTM north	UTM east	SW #	USAF, 1998b UTM north	UTM east	Map #
Springs (continued)														
Bullfrog Hills														
unnamed / Indian Spring, Bullfrog Hills	m	off range, not visited		not listed			11S 46E s26 SE SW	94	4089159.25	517658.906	74	not listed		
Rainier Mesa														
Tub Spring	m	off range (NTS), not visited		not listed			8S 53E s20 NE SW	38	4121836	585149.75	34	4121792	584980	38
Wire Grass Spring	nm	off range (NTS), not visited		not listed			8S 53E s18 NE NE	40	4122522.25	579672.75	36	4122346	582216	40
White Rock Spring	m	off range (NTS), not visited		not listed			9S 52E s4 NE NE	66	4117007.25	577210.75	40	not listed		
Oak Spring	m	off range (NTS), not visited		not listed			8S 52E s13 SW SW	101	4122641.5	582480.688	81	not listed		
Pintwater Range														
Quartz Spring	m	36 59.133	115 36.017	36 59.13	115 35.97	55	11S 57E s20 NW SE	41	4094186.5	624643.188	97	4193857.56	624272.27	41
DeJesus Spring	nm	36 53.003	115 34.456	36 52.31	115 35.62	58	not listed		not listed			not available		71
Tim Spring	m	36 50.953	115 34.182	36 50.92	115 34.14	61	13S 57E s4 SW NE	43	4079034	627590.688	37	4078689.72	628030.67	43
Sand Spring	m	36 49.523	115 34.161	36 49.51	115 34.07	62	13S 57E s15 NW NE	44	4076447.25	627728.125	38	4074394.41	628254.38	44
Pintwater Spring	nm	not visited		36 51.36	115 34.78	60	not listed		not listed			4078736.91	628831.31	69
Warthog Seep	nm	not visited		36 51.48	115 34.77	59	not listed		not listed			4076458.76	627589.47	70
Sheep Range														
Shale Cut Spring	nm	off range, not visited		37 50.84	115 18.62	63	13S 59E s1 SW NE	45	4190209.25	648665.562	39	4079674.07	650088.91	45, 46
White Rock Spring	nm	off range, not visited		not listed			13S 59E s12 SE NW	46	4078102	651588.25	96	not listed		
	nm								4117007.25	577210.75	40			
unnamed	nm	off range, not visited		not listed			15S 60E s12 SE NE	95	4056918.25	661429.188	75	not listed		
unnamed	nm	off range, not visited		not listed			15S 60E s11 NE SW	96	4056435.25	660320.562	76	not listed		

Table C-2. Locations for Reservoirs on the NTTR as determined during field reconnaissance and reported in various publications (continued).

Water Source Name	USGS[1]	NTTR Field Recon. Latitude	Longitude	USAF, 1997[2] Latitude	Longitude	ID #	USAF, 1998[3] / USAF, 1998b[4] Township Range sec	Ref. #[6]	RMO GIS data base[5] UTM north	UTM east	SW #	USAF, 1998b UTM north	UTM east	Map #
Reservoirs														
Cactus Flat														
Cactus Flat pond	nm	not visited		37 44.46	116 28.58	24	not listed		not listed			4177045.05	546070.01	66
N Antelope Reservoir Cactus Flat	nm	37 42.520	116 40.493	not listed			3S 47E s2 NE SE	69	4173781.75	528557.5	51	not listed		
Antelope Reservoir, Cactus Flat	nm	not visited		not listed			3S 48E s19 NE NW	70	4169260.5	531189.812	52	not listed		
	nm								4169263.25	531894.938	83	not listed		
unnamed reservoir	nm	not visited		not listed			3S 48E s19 ?E NW	93	not listed			not listed		
TTR (Sandia Well #6) Pond	nm	tbd		37 46.96	116 44.80	11	not listed		not listed			4181499.65	525574.56	64
Strike Eagle (Sandia Well #8) Pond	nm	tbd		37 43.04	116 43.97	12	not listed		not listed			4174338.46	523515.08	65
Stone Cabin Valley														
Reservoir #2	nm	not visited		not listed			1S 46E s14 NE NE	75	4190081.75	518766.156	57	not listed		
Kawich Valley														
Antelope Reservoir, Kawich V.	m	37 33.652	116 12.019	37 33.75	116 12.00	38	4S 51E s29 SW SW	35	4157576	570653.938	32	not listed		
Coyote Pond	nm	37 37.451	116 11.200	37 32.29	116 09.05	39	4S 51.5E s5 NE SE	20	4154748	575021.938	20	4158247.54	570596.5	20
Kawich Tank (mapped as Lamb's Pond)	m	37 29.673	116 15.028	37 28.90	116 11.74	47	5S 51E s13 SW NW	25	4150796.25	567028	99	4151894.85	566738.12	25
reservoir, sw corner Kawich playa	m	37 28.343	116 14.690	not listed			not listed		not listed			not listed		
Sundown Reservoir	m	37 26.954	116 14.167	not listed			5S 51E s36 SE NE	27	4146092	568392.5	61	not listed		
unnamed, reservoir	nm	not visited		not listed			not listed		not listed			4146984.19	568297.06	27
reservoir, Kawich playa	m	37 26.472	116 13.277	not listed			not listed		not listed			not listed		
reservoir, Kawich playa	m	37 24.510	116 12.206	not listed			not listed		not listed			not listed		
Kawich Valley (continued)														
reservoir, se corner Kawich playa	m	37 26.964	116 11.901	not listed			not listed		not listed			not listed		
Lamb's Pond	nm	not found		37 27.82	116 10.76	48	5S 51E s24 NE NE	26	4146620.5	572564.875	25	4150024.12	568180.14	26
unnamed drainage	nm	not visited		37 26.29	116 10.74	45	not listed		4143631.75	572640.188	26	4154817.87	569271.4	35
reservoir, Kawich playa	m	37 28.751	116 12.356	not listed			not listed		not listed			not listed		
reservoir, Indian Spring pipeline	m	37 27.772	116 07.295	not listed			not listed		not listed			not listed		
reservoir, Kawich valley	nm	37 30.568	116 13.292	not listed			not listed		not listed			not listed		
reservoir, Belted Range	m	37 28.502	116 06.227	not listed			not listed		not listed			not listed		
reservoir, west of Juniper Pass	m	37 35.620	116 04.763	not listed			not listed		not listed			not listed		
Gold Flat														
unnamed, reservoir	nm	not visited		not listed			not listed		not listed			4152522.54	551927.35	
Jackpot Reservoir	m	37 30.686	116 23.691	37 29.75	116 24.54	51	5S 50E s9 SE SE	13	4150043.25	552251.438	13, 86	not listed		
Nixon #2	nm	not found		not listed			5S 49E s27 NW NE	72	4148336.25	544914.062	54	not listed		
Nixon #1	nm	not found		not listed			6S 49E s7 NW SW	71	4143316.25	539544.125	53	not listed		
Sand Spring Valley														
Pink Hills Reservoir	nm	not visited		not listed			3S 54E s21 SW NE	86	4170039.75	596271.625	84	not listed		
Emigrant Valley														
Belted Reservoir #2	nm	not found		not listed			8S 55E s11 NE SE	90	4124469.75	605372.875	71	not listed		
Naquinta Reservoir #1	nm	not found		not listed			7S 55E s14 NE NE	91	4132697.75	605240.375	72	not listed		
Reservoir #4	nm	not found		not listed			9S 54E s10 NW NW	99	4114613	592843.562	79	not listed		
Tikaboo Valley														
Summit Spring Drainage	nm	not visited		37 15.56	116 26.40	54	8S 58E s15 SW NE	48	not listed			4125003.32	636889.76	48
Cresent Valley Res #2	nm	not visited		not listed			not listed		4123724.75	637021	67	not listed		
Cresent Valley Wash	nm	not visited		not listed			9S 59E	84	not listed			not listed		

Table C-2 (cont.). Locations for Reservoirs on the NTTR as determined during field reconnaissance and reported in various publications (continued).

Water Source Name	USGS[1]	NTTR Field Recon. Latitude	Longitude	USAF, 1997[2] Latitude	Longitude	ID #	USAF, 1998[3] / USAF, 1998b[4] Township Range sec	Ref. #[6]	RMO GIS data base[5] UTM north	UTM east	SW #	USAF, 1998b UTM north	UTM east	Map #
Reservoirs (cont.)														
Tolicha Peak														
Tolicha Pond	nm	tbd		37 18.91	116 47.06	32	not listed		not listed			4130992.75	521348.43	75
Pahute Mesa														
Summit Spring Drainage	nm	off range (NTS), not visited		not listed			not listed		4123871.5	548030.625	98	not listed		
Pintwater Range														
Gravel Canyon Guzzler	m	location not determined		36 54.40	115 34.43	57	not listed		not listed			4084648.5	627412.05	68
Indian Spring Canyon Reservoir	m	not visited		36 56.30	115 32.52	56	12S 57E s2 NW NE	42	4087945.5	630624.375	41	4089114.82	628299.13	42
Heaven's Well (Guzzler)	m	location not determined		36 40.00	115 32.00	65	not listed		not listed			not listed		
Dain Peak Catchment	nm	not visited		36 43.00	115 32.00	64	not listed		not listed			not listed		
Desert Dry Lake Valley														
reservoir, se edge playa	nm	36 56.158	115 13.412	not listed			not listed		not listed			not listed		

Table C-3. Locations for Wells and Mine Shafts on the NTTR as determined during field reconnaissance and reported in various publications.

Water Source Name	USGS[1]	NTTR Field Recon. Latitude	Longitude	USAF, 1997[2] Latitude	Longitude	ID #	USAF, 1998[3] / USAF, 1998b[4] Township Range sec	Ref. #[6]	RMO GIS data base[5] UTM north	UTM east	SW #	USAF, 1998b UTM north	UTM east	Map #
Wells and Mine Shafts														
Hot Creek Valley														
Base Camp (#1)	nm	location not determined		not listed			5N 51E s7 NW SE	-- / 25	not listed			not listed		
Base Camp (#2)	nm	location not determined		not listed			5N 51E s7 NW SW	-- / 26	not listed			not listed		
Ralston Valley														
Ralston Valley Road Well	nm	37 52.581	116 55.112	not listed			not listed		not listed			not listed		
Stone Cabin Valley														
Reed's Ranch	nm	tbd		not listed			not listed		4196382.5	521852.688	404	not listed		
BLM (Sandia #3) well	nm	tbd		not listed			1N 46E s25 SW NE	11	4195668	519754.688	358	not listed		
	nm								4195644	519669.688	597	not listed		
Taylor Well	nm	37 53.730	116 37.672	not listed			not listed		not listed			not listed		
Cactus Flat #2 (Monitor Hills) Well	m	37 53.345	116 51.583	not listed			1N 46E s31 SE SE	36	not listed			not listed		
EH-7 Well	nm	37 53.184	116 47.428	not listed			1S 46E s2 NE NW	4 / 10	4193200	518490.656	396	not listed		
TTR Well 1A (well house 670)	nm	37 53.048	116 46.518	not listed			1S 46E s1 NW NE	33 / 11	4192987	519761.156	322	not listed		
Cactus Range														
flooded mine shaft (nw of Cactus Peak)	m	location not determined		not listed			not listed		not listed			not listed		
hand dug, White Patch Draw	nm	37 42.458	116 53.446	not listed			not listed		not listed			not listed		
hand dug, n of White Patch Draw	m	37 42.461	116 53.614	not listed			not listed		not listed			not listed		
Antelope Mine #1	m	location not determined		not listed			not listed		4162148	523880.406	341, 342	not listed		
Antelope Mine #2	m	location not determined		not listed			not listed		4162147.75	523856.156	347	not listed		
Antelope Mine #3	m	location not determined		not listed			not listed		4162178.75	523856.062	352	not listed		
Antelope Mine #4	m	location not determined		not listed			not listed		not listed			not listed		
Sulphide Mine	m	37 34.765	116 43.562	not listed			4S 47E s21 NW SW	24, 29 / 5	4159190.5	524208.219	428	not listed		
Cactus Flat														
EH-6 Well	nm	37 51.670	116 45.976	not listed			not listed	50	4190399.5	520402.25	389	not listed		
TTR Well 3BB	nm	37 50.915	116 46.031	not listed			1S 46E s13 SE NE	48	4189043.75	520454.625	335	not listed		
Sandia #7 (Area 9) Well	nm	tbd		not listed			1S 47E s15 SW NE	19	4189027.75	525807	426	not listed		
TTR Well 3A	nm	37 50.753	116 46.040	not listed			1S 46E s13 SE SE	5 / 12	4188735.5	520455.406	323	not listed		
TTR Well 3B	nm	tbd		not listed			1S 46E s13 SE NE	6 / 13	4189012.75	520454.688	329	not listed		
Sandia #5 well	nm	37 49.989	116 43.219	not listed			not listed	47	4187329.5	524614.625	425	not listed		
EH-5 Well	nm	not found		not listed			not listed		4185961.5	520438.125	388	not listed		
Deadhorse Well	nm	37 49.193	116 37.612	not listed			not listed	41	4185848.25	533004.625	364	not listed		
Sandia #4 Well	nm	tbd		not listed			not listed	55	4183005	521178.969	418	not listed		
Sandia #2 Well	nm	tbd		not listed			not listed	54	4182574.25	521351.375	411	not listed		
Sandia #6 (Main) Well	nm	tbd		not listed			2S 47E s7 NE NE	18	4181898	522086.75	427	not listed		
EH-1 Well	nm	37 47.005	116 45.796	not listed			2S 47E s7 NW NW	32 / 9	4181802	520766.219	370	not listed		
EH-2 Well	nm	37 46.968	116 46.673	not listed			2S 46E s12 NW NE	3 / 8	4181737.5	519543.688	372	not listed		
EH-3 Well	nm	not found		not listed			not listed		4180929.75	516756.625	379	not listed		
EH-4 Well	nm	37 46.271	116 43.984	not listed			not listed	49	4180546	523631.75	380	not listed		
Roller Coaster (Sandia #8) Well	nm	tbd		not listed			2S 47E s32 NE SW	17	4174882.25	523199.125	596	not listed		
Sandia #1 Well	nm	not found		not listed			not listed	34	4182204.75	521572.688	410	not listed		
Mellan Well	nm	not visited		not listed			not listed	44	not listed			not listed		
TTR Fire Pit well #1	nm	not visited		not listed			not listed	58	not listed			not listed		
TTR Fire Pit well #2	nm	not visited		not listed			not listed	59	not listed			not listed		
TTR Fire Pit well #3	nm	not visited		not listed			not listed	60	not listed			not listed		

Table C-3 (cont.). Locations for Wells and Mine Shafts on the NTTR as determined during field reconnaissance and reported in various publications..

Water Source Name	USGS[1]	NTTR Field Recon. Latitude	Longitude	USAF, 1997[2] Latitude	Longitude	ID #	USAF, 1998[3] / USAF, 1998b[4] Township Range sec	Ref. #[6]	RMO GIS data base[5] UTM north	UTM east	SW #	USAF, 1998b UTM north	UTM east	Map #
Wells and Mine Shafts (continued)														
Cactus Flat (continued)														
TTR Landfill	nm	not visited		not listed			not listed	61	not listed			not listed		
TTR Landfill	nm	not visited		not listed			not listed	62	not listed			not listed		
Gold Flat														
Cedar Pass (O&M) Well	m	tbd		not listed			2S 49E s22 SE NW	15 / 24	4177833.5	545566.438	362	not listed		
Site 4	nm	37 42.700	116 25.867	not listed			3S 50E s5 NW SW	2 / 7	not listed			not listed		
	nm								4173938	548819.938	361			
Gold Flat #1 well site	m	37 26.808	116 28.237	not listed			6S 49E s2 NW SW	31	not listed			not listed		
Gold Flat #2 well	m	37 25.669	116 36.588	not listed			6S 48E s9 SE SW	13	4142411.75	534429.625	590	not listed		
	nm						6S 48E s9 SE SE	37						
Gold Flat #2A well	nm	37 25.660	116 36.564	not listed			6S 48E s9 SE SW	37	4142412.25	534429.625	591	not listed		
Salsbury Well	nm	not visited		not listed			6S 48E s18 NW SW	38	not listed			not listed		
Reveille Valley														
Camp's Well	nm	not visited		not listed			1S 51E s11 SW SE	7	not listed			not listed		
Willow Witch Well	m	37 50.495	116 12.520	not listed			not listed		not listed			not listed		
Kawich Valley														
mine shaft (w of playa)	m	37 31.452	116 13.829	not listed			not listed		not listed			not listed		
well, n edge of large playa	nm	37 30.241	116 13.286	not listed			not listed		not listed			not listed		
Floyd Lamb Well	nm	37 25.628	116 12.610	not listed			not listed	40	4142560.25	569896.562	138	not listed		
Kawich	nm	not found		not listed			2S 51E s25 NW SE	39	not listed			not listed		
Penoyer Valley														
South Western	m	off range, not visited		not listed			3S 54E s25 NW NE	27	not listed			not listed		
Emigrant Valley[14]														
WT-1	nm	37 14.650	115 48.533	not listed			not listed		not listed			not listed		
WT-2	nm	37 14.650	115 48.000	not listed			not listed		not listed			not listed		
WT-3	nm	37 15.650	115 50.050	not listed			not listed		not listed			not listed		
WT-4	nm	37 15.583	115 50.267	not listed			not listed		not listed			not listed		
89-70 Well	nm	37 15.583	115 57.583	not listed			not listed		not listed			not listed		
89-72 Well	nm	37 11.550	115 54.833	not listed			not listed		not listed			not listed		
90-70 Well	nm	37 12.017	115 58.700	not listed			not listed		not listed			not listed		
92-70 Well (Stewart Well #1)	nm	37 16.600	115 57.867	not listed			not listed		not listed			not listed		
93-68 Well	nm	37 18.617	116 01.150	not listed			not listed		not listed			not listed		
93-72 Well (Stewart Well #2)	nm	37 18.650	115 55.033	not listed			not listed		not listed			not listed		
Naquinta Valley	nm	not found		not listed			8S 54E s6 NE NE	26	not listed			not listed		
Oak Spring Butte	nm	not found		not listed			8S 54E s6 NW SE	35	not listed			not listed		
Stewart's Wells	nm	not found		not listed			5S 55E s5 SE NW	-- / 15	not listed			not listed		
Stonewall Flat														
Desert Well	m	37 36.298	116 57.932	not listed			4S 54E s15 SE NE	20 / 1	not listed			not listed		
Civet Cat Canyon Well	nm	37 32.716	116 51.217	not listed			not listed	45, 46	not listed			not listed		
Ralston Well	nm	off range, not visited		not listed			not listed		4156515.75	486604.281	255	not listed		

Table C-3 (cont.). Locations for Wells and Mine Shafts on the NTTR as determined during field reconnaissance and reported in various publications..

Water Source Name	USGS[1]	NTTR Field Recon. Latitude	Longitude	USAF, 1997[2] Latitude	Longitude	ID #	USAF, 1998[3] / USAF, 1998b[4] Township Range sec	Ref. #[6]	RMO GIS data base[5] UTM north	UTM east	SW #	USAF, 1998b UTM north	UTM east	Map #
Wells and Mine Shafts (continued)														
Sarcobatus Flat														
TPJ-1	m	off range, not visited		not listed			not listed		4110906.75	513296.188	297	not listed		
TPJ-2	nm	off range, not visited		not listed			not listed		4109459.75	514137.438	315	not listed		
Pahute Mesa														
Gold Crater area	m	37 32.553	116 53.032	not listed			4S 45E s36 SW SE	21 / 2	not listed			not listed		
Franz Hammel Mine	m	37 32.473	116 47.354	not listed			not listed	43	4154923.25	518650.062	139	not listed		
Yellow Tiger	nm	not visited		not listed			5S 44E s1 SW SW	22 / 3	not listed			not listed		
Yellow Tiger	nm	not visited		not listed			5S 44E s1 SW NW	23 / 4	not listed			not listed		
Tolicha Peak														
TPECR Well	nm	tbd		not listed			7S 46E s25 NW NW	1 / 6	not listed			not listed		
Quartz Mt.														
hand dug (n of Quartz Mt.)	m	37 16.912	116 44.058	not listed			not listed		not listed			not listed		
Oasis Valley														
PM-3	nm	location not determined		not listed			not listed		4121495	539001.812	226	not listed		
Stager's	nm	not visited		not listed			10S 49E s17 SE SE	25 / 17	not listed			not listed		
Mercury Valley														
Army #6A	m	off range (NTS), not visited		not listed			not listed		4048390.75	587777.75	73	not listed		
Army #1	m	off range (NTS), not visited		not listed			not listed		4050007.5	586121.125	90	not listed		
Frenchman Flat														
TW-3	m	off range (NTS), not visited		not listed			not listed		4074219.75	601936.312	432	not listed		
Indian Springs Valley														
MW-21	nm	not visited		not listed			not listed	52	4050389	620437.688	556	not listed		
MW-20	nm	not visited		not listed			not listed	51	4050386.25	620239.062	550	not listed		
MW-22	nm	not visited		not listed			not listed	53	4049740.5	620347.062	562	not listed		
TW-10	nm	off range, not visited		not listed			not listed		4050096.25	602646.438	445	not listed		
TW-4	nm	off range, not visited		not listed			not listed		4049756.5	607596.812	447	not listed		
Indian Springs 3	nm	not visited		not listed			not listed		4049479	619282.312	223	not listed		
ISAFAF #62-1 (USAF-1)	nm	36 34.845	115 40.496	not listed			16S 56E s5	9 / 20	4049217.5	618192.25	219, 588	not listed		
ISAFAF #106-2 (USAF-2)	nm	36 34.781	115 40.782	not listed			16S 56E s8	10 / 21	4049213	617868.688	220, 589	not listed		
ISAFAF Well 3 (USAF Well 3)	nm	location not determined		not listed			16S 56E s8	12, 30	4049061.75	618070.125	568	not listed		
Indian Springs USAF-3	nm	off range, not visited		not listed			not listed		4047505.25	619185.438	221	not listed		
Indian Springs D-12	nm	off range, not visited		not listed			not listed		4048768	619142.625	225	not listed		
Cactus Springs Well #2	nm	off range, not visited		not listed			not listed		4048729.25	613997.938	99	not listed		
Cactus Springs Well #1	nm	off range, not visited		not listed			not listed		4048575.25	614000	98	not listed		
Cactus Springs Well #3	nm	off range, not visited		not listed			not listed		4048480.5	613827.125	100	not listed		
Cactus Springs Well #3	nm	off range, not visited		not listed			not listed		4048325	613904.812	92	not listed		
Indian Springs 2	nm	off range, not visited		not listed			not listed		4047934.25	619029.938	222	not listed		
Indian Springs D-11	nm	off range, not visited		not listed			not listed		4047789.25	619678.562	224	not listed		
Army #2	nm	off range, not visited		not listed			not listed		4045398.25	601484.125	1	not listed		
Army #3	nm	off range, not visited		not listed			not listed		4044969.25	609248.125	22, 91	not listed		

Table C-3 (cont.). Locations for Wells and Mine Shafts on the NTTR as determined during field reconnaissance and reported in various publications..

Water Source Name	USGS[1]	NTTR Field Recon. Latitude	Longitude	USAF, 1997[2] Latitude	Longitude	ID #	USAF, 1998[3] / USAF, 1998b[4] Township Range sec	Ref. #[6]	RMO GIS data base[5] UTM north	UTM east	SW #	USAF, 1998b UTM north	UTM east	Map #
Wells and Mine Shafts (continued)														
Three Lakes Valley														
Point Bravo production well	nm	36 32.116	115 33.961	not listed			16S 57E s29 NE NE	14	4044217	628433.562	549	not listed		
Point Bravo back-up	nm	36 32.097	115 33.955	not listed			not listed		not listed			not listed		
Desert Dry Lake Valley														
Desert (Dry) Lake (DDL-1)	m	36 57.193	115 11.858	not listed			not listed		4091182.25	660460.688	104	not listed		
Desert Dry Lake #2 (DDL-2)	nm	36 55.037	115 13.683	not listed			not listed		4087155.75	657838.25	121	not listed		
Las Vegas Valley														
Cow Camp Well	nm	36 34.111	115 21.867	not listed			not listed	28	4048263	646324.125	103	not listed		
DR-1	nm	36 33.471	115 24.647	not listed			not listed		4047114.75	642191	129	not listed		
	nm								4046992.25	642242.875	130	not listed		
Las Vegas Valley (continued)														
South Black Hills #1	nm	36 32.194	115 24.080	not listed			not listed		4044664.75	643151.75	262	not listed		
Alpha Well #3	m	not visited		not listed			not listed	57	4043423.25	636927.875	548	not listed		
Alpha Well #2	nm	not visited		not listed			not listed	56	4041887.25	637250.875	89, 543	not listed		
Silver Flag Alpha (Alpha Well #1)	nm	36 28.527	115 26.945	not listed			17S 58E s14 SW NE	16 / 27[15]	4037752.75	638935.062	534, 542	not listed		
	nm								4037749.5	638736.125	88	not listed		
2362-1	nm	not visited		not listed			17S 58E s14 SE NW	-- / 18	not listed			not listed		
2278-1	nm	not visited		not listed			17S 58E s14 SE NW	-- / 19	not listed			not listed		
2364	nm	not visited		not listed			not listed		4037745.5	638863.688	598	not listed		
Corn Creek NAF-63C	m	off range, not visited		not listed			not listed		4036656.75	643533.625	101	not listed		
Corn Creek Well	nm	off range, not visited		not listed			not listed		4036576	642364.938	102	not listed		
Insufficient information to locate														
Mine Well	nm	not visited		not listed			not listed	42	not listed			not listed		

Notes
[1] US Geological Survey 1:24000 and 1:100000 scale topographic maps, circa 1987. m = mapped; nm = not mapped.
[2] USAF. 1997. Nellis Air Force Range Wetlands Survey Report, Appendix C. 99th Air Base Wing, Environmental Management Directorate, natural Resources, Nellis Air Force Base, Nevada. March, 1997.
[3] USAF. 1998. Final Water Requirements Study of the Nellis Air Force Range, Tables 2.2 and 3.1. US Depart of the Air Force, September, 1998.
[4] USAF. 1998b. Draft Legislative Environmental Impact Statement Renewal of the Nellis Air Force Range Land Withdrawal, Tables 3.6-3 and 3.6-5. US Depart of the Air Force, September, 1998.
[5] Unpublished Range Management Office, Geographic Information System data base.
[6] Reference numbers preceding the / are from USAF, 1998; those following the / are from USAF (1999).
[7] not visited: no attempt was made during field reconnaissance to confirm existence of this water source.
[8] not listed: location for this water source not included in indicated data base.
[9] not found: published location was accessed, but no water source was confirmed during field reconnaissance.
[10] location not determined: a water source was confirmed at the indicated location but location was not determined by GPS.
[11] George's Water is listed here as a spring rather than an underground source as indicated in USAF (1998) and USAF (1999).
[12] Water source preceded by * is a feature maintained by piped water from preceding water source.
[13] This water source, though not on modern maps, is shown on the hisorirc map prepared by Ball (1907)
[14] Locations for wells in Emigrant Valley were taken from Fenix & Sission (1989).
[15] The location, in the vicinity of Base Camp, given for Silver Flag Alpha in USAF (1999) is incorrect.
tbd: latitude/longitude coordinates of location are to be converted from UTM coordinates determined during field reconnaissance.

Table C-4. Major Ion Chemistry for NTTR Springs.
(NOTE: Table C-4 lists only those springs and wells from which samples were obtained or water chemistry data were available.)

Site	Date	Lab pH	Lab EC	SiO2 mg/l	HCO3 mg/l	CO3 mg/l	Cl mg/l	SO4 mg/l	NO3 mg/l	Na mg/l	K mg/l	Ca mg/l	Mg mg/l	Cations meq/l	A / C ~1.0	Ref.
Springs																
Goldfield Hills																
Wildhorse Spring	06/24/00	7.63	387	39.40	90.20	0.00	41.00	45.40	13.60	44.10	3.50	28.20	3.50	3.700	1.027	
Cactus Range																
Stealth Spring	08/28/00	7.78	402	46.10	184.00	0.00	39.40	42.20	11.40	52.50	2.90	44.90	6.90	5.170	1.004	
Alkali Spring	06/13/00	8.19	1400	41.10	238.00	0.00	28.00	613.00	0.04	68.10	5.60	243.00	24.50	17.250	1.012	
Cactus Spring	05/15/00	7.77	509	31.40	233.00	0.00	25.90	67.30	0.09	53.20	2.54	54.10	7.27	5.680	1.048	
Antelope Spring	05/17/00	7.72	441	38.30	267.00	0.00	14.70	21.90	<0.04	30.60	3.16	63.50	7.03	5.160	1.017	
Kawich Range																
Breen Spring	06/23/00	7.78	218	53.00	120.00	0.00	7.60	8.10	<0.04	19.80	1.20	23.50	3.10	2.320	1.013	
Tramp Spring	06/26/00	7.94	325	29.10	207.00	0.00	9.90	13.90	1.42	45.00	0.72	32.10	3.50	3.870	1.028	
Silverbow Spring	07/24/96	na	na	na	na	na	22.60	43.30	nd	47.00	2.30	49.10	9.10	na		5
Georges Water	06/15/00	7.56	159	48.80	84.90	0.00	4.70	8.80	0.09	14.20	1.10	17.20	2.70	1.730	0.988	
Corral Spring	05/18/00	7.72	608	41.80	268.00	0.00	39.90	87.60	0.18	75.00	2.86	67.60	5.77	7.180	1.022	
Sumner Spring	05/02/96	na	na	na	na	na	23.60	50.10	nd	41.00	2.70	62.70	8.70	na		5
	09/24/96	na	na	na	na	na	22.80	50.50	nd	43.10	2.10	65.80	9.00	na		5
	06/14/00	7.96	530	41.60	248.00	0.00	24.30	51.40	1.11	40.20	2.10	63.30	8.10	5.630	1.037	
Cedar Spring	06/14/00	8.18	502	46.90	232.00	0.00	23.90	37.90	6.73	61.50	2.90	42.50	6.60	5.410	0.993	
Rose Spring	05/02/96	na	na	na	na	na	23.00	49.50	nd	44.00	1.90	82.40	11.20	na		5
	05/18/00	7.74	591	39.40	317.00	0.00	24.20	52.90	3.72	43.10	2.25	81.20	10.20	6.820	1.032	
Stonewall Mt.																
Stonewall Spring	06/24/00	8.35	274	47.50	141.00	1.30	10.50	14.70	0.13	22.10	1.10	30.30	4.90	2.900	1.021	
Belted Range																
Cliff Spring	07/10/00	7.86	244	34.80	110.00	0.00	13.50	20.30	0.35	43.60	0.60	10.10	1.20	2.520	1.036	
Indian Spring	07/11/00	7.52	299	62.10	160.00	0.00	8.30	19.80	0.75	18.70	4.90	36.70	6.40	3.300	0.994	
Wheelbarrow Spring	07/12/00	8.11	324	29.10	164.00	0.00	14.80	21.80	<0.04	42.00	3.60	24.10	6.00	3.620	0.983	
Wild Cat Spring	10/06/93	8.12	252	38.60	107.00	0.00	12.50	16.40	2.97	14.60	4.60	24.60	5.68	2.447	1.020	7
Chalk Mountain																
White Blotch Spring	03/18/92	7.78	214	44.90	81.40	0.00	6.69	18.00	8.90	12.30	5.72	21.00	4.50	2.099	0.972	7
Groom Range																
Old Tikaboo	08/15/93	7.52	904	33.00	359.00	0.00	13.50	210.00	<0.04	20.70	5.36	84.90	61.70	10.348	1.028	3
April Fool	08/15/93	8.02	802	23.80	370.00	0.00	21.80	128.00	0.27	33.60	4.49	76.50	43.60	8.979	1.041	7
Sharp	08/15/93	7.59	579	31.40	247.00	0.00	16.80	91.20	<0.04	22.50	4.04	46.00	34.40	6.207	1.034	7

Table C-4 (continued). Major Ion Chemistry for NTTR Springs.
(NOTE: Table C-4 lists only those springs and wells from which samples were obtained or water chemistry data were available.)

Site	Date	Lab pH	Lab EC	SiO2 mg/l	HCO3 mg/l	CO3 mg/l	Cl mg/l	SO4 mg/l	NO3 mg/l	Na mg/l	K mg/l	Ca mg/l	Mg mg/l	Cations meq/l	A / C ~1.0	Ref.
Springs (continued)																
Groom Range (continued)																
Rosebud Spring	05/xx/85	7.25	845	na	398.00	0.00	10.90	151.00	na	18.20	2.00	88.80	60.00	na		3
Savio Spring	05/xx/85	8.34	471	na	268.00	1.50	10.10	25.50	na	23.70	6.20	54.50	14.00	na		3
	08/14/93	7.72	565	75.90	258.00	0.00	22.30	57.20	2.44	41.20	10.40	52.30	15.30	5.926	1.027	7
Lick Spring	05/xx/85	8.25	410	na	244.00	0.00	9.40	26.00	na	27.60	4.50	48.10	10.50	na		3
Rabbitbrush Spring	05/xx/85	7.88	375	na	197.00	0.00	9.00	27.20	na	25.40	3.50	42.10	8.90	na		3
	08/14/93	7.54	375	59.40	197.00	0.00	9.30	22.30	0.53	24.60	2.53	40.60	8.45	3.856	1.028	7
Naquita Spring	05/xx/85	8.20	308	na	180.00	0.00	5.70	12.20	na	24.50	1.10	31.60	10.50	na		3
	07/16/91	8.10	278	22.60	162.00	0.00	4.50	11.00	2.48	23.30	0.74	26.60	8.81	3.084	0.989	7
	07/19/00	8.06	357	29.50	180.00	0.00	9.80	32.70	1.37	39.90	0.90	30.90	7.22	3.890	1.010	
Pine Spring	05/xx/85	8.47	424	na	222.00	5.20	12.30	23.70	na	53.80	2.50	32.40	8.20	na		3
Indian Spring	05/xx/85	8.12	356	na	173.00	0.00	9.40	31.40	na	38.60	0.90	29.90	7.10	na		3
	06/13/91	8.15	365	26.80	184.00	0.00	9.96	31.10	1.33	39.60	0.86	29.90	1.01	3.818	1.039	7
	07/20/00	7.93	284	22.30	187.00	0.00	5.30	12.90	1.46	23.60	0.90	30.60	10.40	3.430	1.023	
Quail Spring	05/xx/85	7.80	668	na	166.00	0.00	11.00	206.00	na	28.50	1.90	85.60	19.20	na		3
	08/14/93	7.84	666	39.50	167.00	0.00	11.10	197.00	<0.04	27.50	2.09	86.10	18.50	7.068	1.012	7
Cliff Spring	05/xx/85	7.72	508	na	271.00	0.00	6.50	50.60	na	18.40	0.90	75.70	11.40	na		3
	08/20/93	7.78	479	30.50	263.00	0.00	5.30	42.30	0.40	17.90	0.91	68.60	10.50	5.089	1.051	7
Cattle Spring	05/xx/85	7.98	526	na	261.00	0.00	16.00	39.30	na	40.50	5.30	56.00	11.40	na		3
	06/13/91	7.87	501	45.80	258.00	0.00	12.90	36.60	7.18	41.30	5.45	52.10	10.30	5.383	1.016	7
	08/08/00	7.61	491	49.90	257.00	0.00	13.30	39.30	7.13	40.70	5.10	53.00	10.60	5.420	1.018	
Rock Spring	05/xx/85	7.78	581	na	348.00	0.00	5.80	35.00	na	13.10	1.70	86.50	18.70	na		3
	08/14/93	7.76	587	24.90	353.00	0.00	6.10	32.50	1.02	13.60	1.78	87.10	18.60	6.513	1.021	7
Cane Spring	05/xx/85	7.61	807	na	360.00	0.00	17.90	136.00	na	23.70	2.40	84.20	48.40	na		3
	09/15/93	7.96	789	21.50	359.00	0.00	18.50	134.00	1.59	22.70	5.54	82.40	45.10	8.950	1.030	7
Miner Spring	05/xx/85	7.91	1710	na	485.00	0.00	52.90	585.00	na	96.90	12.00	96.70	153.00	na		3
	03/27/96	8.29	1730	39.10	417.00	0.00	52.60	556.00	0.13	90.70	9.43	95.40	125.00	19.227	1.035	7
Disappointment Spring	10/23/96	8.12	870	29.20	380.00	0.00	23.90	147.00	0.18	40.40	6.12	56.40	62.40	9.860	1.011	7
Jumbled Hills																
Summit (Mud) Spring	05/07/99	8.15	505	62.80	222.00	0.00	22.00	40.50	18.30	33.10	8.73	58.60	8.09	5.253	1.028	7
Quartz Mt (Tolicha)																
Pillar Spring	08/27/00	7.64	164	41.00	84.30	0.00	2.30	4.40	0.04	11.90	0.10	17.40	3.41	1.670	0.922	
Pintwater Range																
Quartz Spring	05/09/87	7.80	780	52.00	420.00	nd	25.00	67.00	1.40	54.00	3.70	76.00	39.00	na		6
	01/02/88	8.20	790	80.00	380.00	nd	31.00	80.00	6.20	54.00	2.20	67.00	39.00	na		6

Table C-4 (continued). Major Ion Chemistry for NTTR Springs.
(NOTE: Table C-4 lists only those springs and wells from which samples were obtained or water chemistry data were available.)

Site	Date	Lab pH	Lab EC	SiO2 mg/l	HCO3 mg/l	CO3 mg/l	Cl mg/l	SO4 mg/l	NO3 mg/l	Na mg/l	K mg/l	Ca mg/l	Mg mg/l	Cations meq/l	A / C ~1.0	Ref.
Springs (continued)																
Pintwater Range (continued)																
Quartz Spring	12/21/00	8.04	927	58.90	453.00	0.00	38.40	110.00	14.20	78.30	2.73	72.50	42.40	10.580	1.043	
DeJesus Spring	05/09/87	7.80	580	16.00	290.00	nd	14.00	64.00	2.20	18.00	3.70	41.00	45.00	na		6
	12/02/00	8.19	498	15.60	234.00	0.00	12.00	41.10	29.90	20.20	2.58	51.90	20.00	5.180	1.064	
Tim Spring	01/02/88	8.10	360	37.00	140.00	nd	11.00	37.00	nd	13.00	2.90	19.00	28.00	na		6
	12/02/00	8.00	368	11.00	146.00	0.00	11.00	39.10	19.90	13.30	2.93	18.50	26.50	3.760	1.021	
Sand Spring	01/03/88	8.70	470	24.00	220.00	nd	16.00	24.00	nd	19.00	4.60	19.00	44.00	na		6
	12/02/00	8.28	482	18.20	281.00	0.00	13.00	21.30	13.60	16.60	4.69	32.30	36.80	5.480	1.027	

Table C-5. Field reconnaissance data for springs: location, chemistry, discharge.

Water Source Name	Field Reconnaissance Date	Time	Latitude	Longitude		Chemistry Parameters Temp. (°C)	pH	EC (us/cm)	DO (mg/l)	Discharge Q (lpm)	Ref.
Springs											
Goldfield Hills											
Tognoni Spring	off range, not visited										
Wildhorse Spring	06/24/00	09:20 AM	37 43.483	117 05.354	pool in tunnel; no visible flow	15.2	7.05	387	5.99	nm	
Cane (Willow) Spring, Goldfield Hills	off range, not visited										
unnamed	off range, not visited										
unnamed, east Goldfield Hills	06/24/00	10:44 AM	37 41.863	117 03.786	dry						
Cactus Range											
unnamed, west of Cactus Peak	05/16/00	03:32 PM	not found								
unnamed, southwest of Cactus Peak	05/16/00	03:32 PM	not found								
unnamed, south of Cactus Peak	05/16/00	01:49 PM	37 44.972	116 51.848	grassy area						
Stealth Spring	08/28/00	08:00 AM	37 45.398	116 50.362	sampled	16.7	7.23	475	6.13	2	
Alkali Spring	06/13/00	09:00 AM	37 42.429	116 51.366	sampled	16.2	6.45	1383	7.85	3.5	
Sleeping Column Spring	not visited				may be same as Alkali Spring						
Cactus Spring	05/15/00	02:48 PM	37 43.270	116 49.005	larger of 2 orifices	14	7.31	409	2.42	3.6	
Urania Mine Seep	05/15/00	06:37 PM	37 41.831	116 49.211	not able to sample						
unnamed, south of Urania Mine	05/16/00	05:38 PM	37 41.331	116 48.898	grassy area						
Antelope Spring	05/17/00	11:13 AM	37 37.179	116 43.506	2 orifices, ponded, no visible flow						
above Antelope Spring	05/17/00	12:22 PM	37 37.076	116 43.742	sampled	12.5	7.17	555	3.35	0.8	
south of Antelope Spring	06/14/00	08:47 AM	37 36.950	116 43.634	grassy area						
Cactus Flat											
Fork Spring	08/26/00	na	not found								
Kawich Range											
Silverbow Canyon (Breen Ck Marsh)	06/23/00	02:14 PM	37 55.058	116 28.134		12.1	6.89	215	3.8	38/102.7[1]	
Stinking Spring	06/23/00	12:48 PM	37 53.662	116 31.557	4 small pools, no visible flow						
Silverbow (Breen) Creek	06/13/00	na	not determined		dry						
Silverbow Spring	07/24/96	na	37 52.067	116 30.383		24	7.1	577	4	na	5
	06/13/00	na	not determined		dry						
Tramp Spring	06/26/00	09:45 AM	37 53.265	116 22.093	sampled	13.1	7.47	353	6.77	1.7	
Thunderbird Spring	06/13/00	04:47 PM	37 52.535	116 24.567	2 ponds, no visible flow						
unnamed, southeast of Nixon Peak	06/13/00	03:53 PM	37 52.296	116 26.593	grassy area						
Blackhawk Spring	06/13/00		not found		may be same as Thunderbird						
Sandeen Spring	06/16/00	07:31 AM	37 51.909	116 23.778	not sampled						
Phantom Spring	06/16/00	09:51 AM	not found								
George's Water	06/15/00	09:45 AM	37 51.589	116 20.977	piped to valley	10	6.68	161	3.85	12.2/75.6[2]	
* George's Water pipeline trough	06/26/00	08:44 AM	37 51.582	116 16.237	piped	na	na	na	na	3.8	
* corral below George's Water	06/15/00	11:45 AM	37 53.660	116 15.312	piped	na	na	na	na	28.6	

Table C-5 (continued). Field reconnaissance data for springs: location, chemistry, discharge.

Water Source Name	Date	Time	Field Reconnaissance Latitude	Longitude		Chemistry Parameters Temp. (°C)	pH	EC (us/cm)	DO (mg/l)	Discharge Q (lpm)	Ref.
Springs (continued)											
* corral at Willow Witch Well	06/15/00	12:06 PM	37 50.495	116 12.520	piped	na	na	na	na	31	
Tunnel Spring	06/13/00	01:08 PM	37 47.395	116 23.120	pool in tunnel; no sample	21	na	580	na	0.2	
Corral Spring	05/18/00	05:00 PM	37 47.056	116 23.032	multiple troughs; sampled	12.7	7.37	677	na	>1.6	
* Corral Spring, north	see above										
* Corral Spring, south	see above										
* Coral (Corral) Spring	see above										
Harley Spring	not visited										
Jarboe Spring	07/14/00	08:37 AM	not found								
unnamed, west of Jarboe Spring	not visited										
Sumner (Summer) Spring	05/02/96	na	37 46.383	116 17.417		15	7.8	530	5	na	5
	09/24/96	na	37 46.383	116 17.417		na	7.7	551	na	na	5
	06/14/00	05:15 PM	37 46.369	116 17.458	piped with Cedar Spr	16.5	7.28	533	5.2	0.0/41.8[3]	
* corral below Cedar	06/15/00	01:30 PM	37 45.696	116 10.694	piped					7.5	
* Cedar Ranch trough	06/15/00	02:28 PM	37 45.185	116 07.755	piped					34.3	
Log Spring	05/18/00	na	not found								
Cedar Spring	06/14/00	03:27 PM	37 45.081	116 16.378	piped with Sumner Spg	14.1	7.43	503	4.87	see Sumner	
Rose Spring	05/02/96	na	37 44.767	116 19.933		18	7.4	668	5	na	5
	05/18/00	10:39 AM	37 44.776	116 19.877	sampled pipeline	14.6	7.43	535	n/a	0.0/7.5[4]	
* Rose Spring trough (pond)	06/14/00	11:42 AM	37 44.355	116 25.033	piped, trough overflow					7.5	
* Wild Horse Ranch trough	06/14/00	01:07 PM	37 42.409	116 24.066	dry					0	
Cedar Wells	06/15/00	03:20 PM	37 42.007	116 16.085	dry						
Wild Horse Draw Spring	07/13/00	04:53 PM	not found								
Granite Spring	06/15/00	04:33 PM	37 36.831	116 20.050	dry						
Cedar Pass Spring	not visited										
Kawich Valley											
unnamed spring	not visited										
Stonewall Mountain											
Stonewall Spring	06/24/00	02:00 PM	37 32.436	117 03.862	orifice high on rock face	13	8.69	266	8.09	30	
unnamed, west of Stonewall Spring	06/24/00	03:34 PM	37 31.748	117 04.570	pool, no visible flow						
Jerome Spring	not visited										
Belted Range											
Cliff Spring, Belted Range	07/10/00	01:47 PM	37 30.677	116 05.278	sampled at trough valve	nm	nm	nm	nm	nm	
unnamed, above Cliff Spring, Belted R.	07/10/00	na	37 30.691	116 04.974	grassy area						
unnamed, wnw of Cliff Spring, Belted R.	07/10/00	04:13 PM	37 30.825	116 05.682	seep from rock face						
Shirley Spring	07/11/00	na	not found								
Indian Spring, Belted Range	07/11/00	03:13 PM	37 26.514	116 06.044	sampled	10.3	na	na	na	na	

Table C-5 (continued). Field reconnaissance data for springs: location, chemistry, discharge.

Water Source Name	Date	Time	Field Reconnaissance Latitude	Longitude		Chemistry Parameters Temp. (°C)	pH	EC (us/cm)	DO (mg/l)	Discharge Q (lpm)	Ref.
Springs (continued)											
Belted Range (continued)											
Wheelbarrow, n of Indian Spg, Belted R.	07/12/00	10:20 AM	37 28.879	116 05.737	sampled, drip behind rock slab	13.8	na	na	na	na	
Falcon Spring	not visited										
Wildcat Spring	10/06/93	na			sample shallow discharge	na	na	na	na	~0.1	7
	07/12/00	na	not found								
Pony Spring	07/12/00	12:38 PM	not found								
Horse Spring	07/13/00	11:10 AM	not found								
Gold Spring	07/13/00	02:31 PM	not found								
unnamed, sse Belted Peak	not visited										
unnamed	not visited										
unnamed	not visited										
Johnnie's Water (Spring)	not visited										
unnamed, ssw of Belted Peak	07/12/00		not found								
Groom Range											
unnamed (watertank)	not visited										
Old Tikapoo	08/15/93	na	37 32.092	115 44.642		16.1	6.61	902	na	na	7
April Fool	08/15/93	na	37 31.872	115 44.292		16.1	7.5	813	na	na	7
Rosebud	05/xx/85	na	37 29.725	115 45.825		10.3	na	na	na	12	3
Sharp	08/15/93	na	37 31.683	115 44.817		17.5	6.66	563	na	12.6	7
New Tikapoo	08/15/93	na	37 31.567	115 44.383	seep, not sampled						
Savio	05/xx/85	na	37 29.500	115 42.300		18.6	na	na	na	20	3
	08/14/93	na				15.6	7.31	564	na	na	7
Lick 05/xx/85	na	37 29.308	115 41.925		18.4	na	na	na	4	3	
Rabbit Brush	05/xx/85	na	37 28.967	115 41.375		14.4	na	na	na	46	3
	08/14/93	na				17.4	6.9	546	na	2.5	7
Naquinta Spring	05/xx/85	na	37 27.687	115 44.932		16.5	na	na	na	60	3
	07/16/91	na				15	7.37	299	na	15	7
	07/19/00	08:19 AM			dispersed seep area	13.7	7.48	360	na	>44	
Pine	05/xx/85	na	37 26.743	115 45.360		20.2	na	na	na	3	3
	10/15/96	na			seep to pool, no measurable flow						
	07/19/00	10:57 AM			seep to pool, no measurable flow						
Indian Spring (Groom Range)	05/xx/85	na	37 26.322	115 45.371		14.4	na	na	na	6	3
	06/14/91	na				15	7.74	493	na	7.5	7
	10/15/96	na				na	na	na	na	3.7	7
	07/20/00	10:15 AM			2 orifices, pipe + seep	15.8	7.92	355	na	7	
Quail Spring	05/xx/85	na	37 26.033	115 41.275		15	na	na	na	8	3
	08/14/93	na				17	7.68	660	na	22	7
Alum	05/xx/85		not found								

Table C-5 (continued). Field reconnaissance data for springs: location, chemistry, discharge.

Water Source Name	Date	Time	Field Reconnaissance Latitude	Longitude		Chemistry Parameters Temp. (°C)	pH	EC (us/cm)	DO (mg/l)	Discharge Q (lpm)	Ref.
Springs (continued)											
Groom Range (continued)											
Cliff Spring, Groom Range	05/xx/85	na	37 25.517	115 44.900		13	na	na	na	8	3
	08/20/93	na				15.1	7.17	467	na	1.8	7
Cattle Spring	05/xx/85	na	37 24.850	115 47.200		16.5	na	na	na	8	3
	06/13/91	na				19.3	6.99	580	na	2.5	7
	10/15/96	na				na	na	na	na	4.1	7
	08/08/00	11:15 AM			sampled collection box	16.4	6.87	490	9.7	4.3	
Rock Spring (Tikaboo V.)	05/xx/85	na	37 24.242	115 42.725		16	na	na	na	na	3
	08/14/93	na				14.6	7.16	580	na	>1.1	7
Cane Spring (Groom Range)	05/xx/85	na	37 20.250	115 45.025		13	na	na	na	8.5	3
	09/15/93	na			sampled corral trough	23.4	7.27	773	na	13	7
Miners Spring	05/xx/85	na	37 19.808	115 47.033		na	na	na	na	na	3
	03/27/96	na				na	na	na	na	na	7
Disappointment Spring	05/xx/85	na	37 19.592	115 47.392		na	na	na	na	na	3
	10/23/96	na			sampled pond	10.1	8.22	778	na	na	7
Chalk Mountain											
Beck Spring	08/29/97	na	not determined		flow not measurable						
Chalk Spring	not visited				may be same as White Blotch Spring						
White Blotch Spring	03/18/92	na	37 31.633	115 56.025	pool in tunnel; no visible flow	8.5	6.99	210	na	na	7
Jumbled Hills											
Summit Spring	05/07/99	na	37 15.900	115 38.175	piped to drainage channel	14.9	7.08	577	na	0.4	7
Mount Irish											
Tule Spring	off range, not visited										
Tolicha Peak											
Monte Cristo Spring	08/25/00	01:03 PM	37 18.254	116 50.059	flow not measurable						
Rock Spring	08/25/00	12:04 PM	not found								
Trapman Spring	08/25/00	02:10 PM	37 17.435	116 51.221	grassy area						
Tule George Spring	08/25/00	10:42 AM	not found								
Pahute Mesa											
Larry's Seep ***	08/26/00	03:46 PM	not found								
Black Rock Spring	off range (NTS), not visited										
Kihibab Spring	off range (NTS), not visited										
Live Oak Spring	off range (NTS), not visited										

Table C-5 (continued). Field reconnaissance data for springs: location, chemistry, discharge.

Water Source Name	Date	Time	Field Reconnaissance Latitude	Longitude		Chemistry Parameters Temp. (°C)	pH	EC (us/cm)	DO (mg/l)	Discharge Q (lpm)	Ref.
Springs (continued)											
Quartz Mountain											
Pillar Spring	08/27/00	09:11 AM	37 15.882	116 41.477	flow from fractured basalt	17.9	na	na	na	5.5	
unnamed seep (Black Mt/Pillar Spg)	08/27/00	12:45 PM	not determined		no visible flow						
Black Mountain											
unnamed seep (north side Black Mt)	08/27/00	01:10 PM	not determined		no visible flow						
Bullfrog Hills											
unnamed / Indian Spring, Bullfrog Hills	off range, not visited										
Rainier Mesa											
Tub Spring	off range (NTS), not visited										
Wire Grass Spring	off range (NTS), not visited										
White Rock Spring	off range (NTS), not visited										
Oak Spring	off range (NTS), not visited										
Pintwater Range											
Quartz Spring	05/09/87	na	36 59.133	115 36.017		18	na	na	na	na	6
	01/02/88	na				18	8	800	11	na	6
	12/21/00	10:42 AM			sampled pipeline	9.5	7.34	955	na	nm	
DeJesus Spring	05/09/87	na	36 53.003	115 34.456		15	7.5	590	na	na	6
	12/02/00	10:30 AM			sampled collection box	11.4	8.06	487	na	nm	
Tim Spring	01/02/88	na	36 50.953	115 34.182		14	8.4	340	na	na	6
	12/02/00	08:50 AM			piped to trough	15.9	7.85	362	na	1.7	
Sand Spring	01/03/88	na	36 49.523	115 34.161		15	9.2	450	na	na	6
	12/02/00	na			sampled collection box	na	na	na	na	nm	
Pintwater Spring	not visited										
Warthog Seep	not visited										
Sheep Range											
Shale Cut Spring	off range, not visited										
White Rock Spring	off range, not visited										
unnamed	off range, not visited										
unnamed	off range, not visited										

Table C-6. Field reconnaissance data for reservoirs: location, chemistry, discharge.

Water Source Name	Date	Time	Field Reconnaissance Latitude	Longitude		Chemistry Parameters Temp. (°C)	pH	EC (us/cm)	DO (mg/l)	Discharge Q (lpm)	Ref.
Reservoirs											
Cactus Flat											
Cactus Flat (O & M well) pond	09/13/00	na	37 44.791	116 28.990	supplied from groundwater						
N Antelope Reservoir Cactus Flat	06/14/00	07:39 AM	37 42.520	116 40.493	dry						
Antelope Reservoir, Cactus Flat	not visited										
unnamed reservoir	not visited										
TTR (Sandia Well #6) Pond	09/13/00	na	37 47.020	116 45.012	supplied from groundwater						
Strike Eagle (Sandia Well #8) Pond	09/13/00	na	37 43.247	116 44.290	supplied from groundwater						
Stone Cabin Valley											
Reservoir #2	05/xx/00	na	not determined		may be the TTR wastewater pond(s)						
Kawich Valley											
Antelope Reservoir, Kawich V.	07/10/00	na	37 33.652	116 12.019	dry						
Coyote Pond	07/10/00	05:54 PM	37 37.451	116 11.200	dry						
Kawich Tank (mapped as Lamb's Pond)	07/11/00	08:00 AM	37 29.673	116 15.028	dry						
reservoir, sw corner Kawich playa	07/11/00	08:15 AM	37 28.343	116 14.690	standing water						
Sundown Reservoir	07/11/00	08:48 AM	37 26.954	116 14.167	dry						
unnamed, reservoir	not visited										
reservoir, Kawich playa	07/11/00	09:03 AM	37 26.472	116 13.277	dry						
reservoir, Kawich playa	07/11/00	09:25 AM	37 24.510	116 12.206	dry						
reservoir, se corner Kawich playa	07/11/00	na	37 26.964	116 11.901	may be Lamb's Pond						
Lamb's Pond	07/11/00	12:50 PM	not found								
unnamed drainage	not visited										
reservoir, Kawich playa	07/11/00	01:02 PM	37 28.751	116 12.356	dry						
reservoir, Indian Spring pipeline	07/13/00	03:13 PM	37 27.772	116 07.295	dry						
reservoir, Kawich valley	07/12/00	08:43 AM	37 30.568	116 13.292	dry						
reservoir, Belted Range	07/12/00	09:41 AM	37 28.502	116 06.227	dry						
reservoir, west of Juniper Pass	07/13/00	12:13 PM	37 35.620	116 04.763	dry						
Gold Flat											
unnamed, reservoir	08/26/00	na	not found		man be same as Jackpot Res.						
Jackpot Reservoir	08/26/00	08:19 AM	37 30.686	116 23.691	standing water						
Nixon #2	08/26/00	10:41 AM	not found								
Nixon #1	08/25/00	04:22 PM	not found								
Sand Spring Valley											
Pink Hills Reservoir	not visited										

Table C-6 (continued). Field reconnaissance data for reservoirs: location, chemistry, discharge.

Water Source Name	Field Reconnaissance Date	Time	Latitude	Longitude		Chemistry Parameters Temp. (°C)	pH	EC (us/cm)	DO (mg/l)	Discharge Q (lpm)	Ref.
Reservoirs (continued)											
Emigrant Valley											
Belted Reservoir #2	02/xx/91		not found								
Naquinta Reservoir #1	02/xx/91		not found								
Reservoir #4	02/xx/91		not found								
Tikaboo Valley											
Summit Spring Drainage	not visited										
Cresent Valley Res #2	not visited										
Cresent Valley Wash	not visited										
Tolicha Peak											
Tolicha Pond	09/14/00	08:00 AM	37 18.535	116 47.076	supplied from groundwater						
Pahute Mesa											
Summit Spring Drainage	off range (NTS), not visited										
Pintwater Range											
Gravel Canyon Guzzler	not visited										
Indian Spring Canyon Reservoir	not visited										
Heaven's Well (Guzzler)	not visited										
Dain Peak Catchment	not visited										
Desert Dry Lake Valley											
reservoir, se edge playa	10/25/00	11:35 AM	36 56.158	115 13.412	dry						

Table C-7. Field reconnaissance data for wells and mine shafts: location, chemistry, discharge.

Discharge Water Source Name	Ref. Date	Time	Field Reconnaissance Latitude	Longitude	Chemistry Parameters (^{o}C)	Temp.	pH	EC (us/cm)	DO (mg/l)	Q (lpm)
Wells and Mine Shafts										
Hot Creek Valley										
Base Camp (#1)	01/26/01	na	not determined	production well	nm	nm	nm	nm	nm	
Base Camp (#2)	01/26/01	na	not determined	reserve well	nm	nm	nm	nm	nm	
Ralston Valley										
Ralston Valley Road Well	08/24/00	01:56 PM	37 52.581 116 55.112	not accessible; not operational						
Stone Cabin Valley										
Reed's Ranch	09/13/00	05:31 PM	not determined							
BLM (Sandia #3) well	08/xx/85	na	37 54.490 116 46.571		na	na	na	na	na	4
	04/xx/87	na			17.5	7.8	418	na	na	4
	09/12/00	na		production well	17.9	7.89	442	7.09	pumped	
Taylor Well	06/23/00	12:18 PM	37 53.730 116 37.672	not accessible						
Cactus Flat #2 (Monitor Hills) Well	08/24/00	03:30 PM	37 53.345 116 51.583	not accessible						
EH-7 Well	09/13/00	10:45 AM	37 53.184 116 47.428	production well	20.5	7.96	459	7.21	pumped	
TTR Well 1A (well house 670)	12/xx/83	na	37 53.048 116 46.518		na	na	na	na	na	4
	04/xx/87	na			20	7.58	383	na	na	4
	08/24/00	02:54 PM		not accessible						
TTR Well 3A	12/xx/83	na	37 50.753 116 46.040		na	na	na	na	na	4
	09/13/00	02:45 PM		production well	20.7	8.73	345	3.1	pumped	
TTR Well 3B	01/xx/85	na	not determined		na	na	na	na	na	4
	04/xx/87	na			20	8.21	405	na	na	4
	09/12/00	02:30 PM	production well		20.8	8.16	389	7.19	pumped	
Cactus Range										
flooded mine shaft, nw Cactus Peak	05/16/00	03:32 PM	not determined	flooded mine shaft						
hand dug, White Patch Draw	06/12/00	03:05 PM	37 42.458 116 53.446	shallow, dry						
hand dug, n of White Patch Draw	06/12/00	03:28 PM	37 42.461 116 53.614	shallow, dry						
Antelope Mine #1	05/17/00	02:00 PM	not determined	flooded mine shaft						
Antelope Mine #2	05/17/00	02:00 PM	not determined	flooded mine shaft						
Antelope Mine #3	05/17/00	02:00 PM	not determined	flooded mine shaft						
Antelope Mine #4	05/17/00	02:00 PM	not determined	flooded mine shaft						
Sulphide Mine	05/17/00	04:33 PM	37 34.765 116 43.562	flooded mine shaft						
Cactus Flat										
EH-6 Well	08/24/00	04:09 PM	37 51.670 116 45.976							
TTR Well 3BB	08/24/00	04:17 PM	37 50.915 116 46.031							

Table C-7 (continued). Field reconnaissance data for wells and mine shafts: location, chemistry, discharge.

Water Source Name	Date	Time	Field Reconnaissance Latitude	Longitude		Chemistry Parameters Temp. (°C)	pH	EC (us/cm)	DO (mg/l)	Discharge Q (lpm)	Ref.
Wells and Mine Shafts (continued)											
Cactus Flat (continued)											
Sandia #7 (Area 9) Well	12/xx/83	na	37 50.899	116 42.3989		na	na	na	na	na	4
	04/xx/87	na				17	8.22	310	na	na	4
	09/13/00	10:30 AM			production well	17.8	7.98	313	8.02	pumped	
Sandia #5 well	08/26/00	05:35 PM	37 49.989	116 43.219	monitoring						
EH-5 Well			not located								
Deadhorse Well	08/26/00	05:57 PM	37 49.193	116 37.612	dry						
Sandia #4 Well			37 47.645	116 45.567	monitoring						
Sandia #2 Well			37 47.424	116 45.452	monitoring						
Sandia #6 (Main) Well	12/xx/83	na	37 47.020	116 45.012		na	na	na	na	na	4
	04/xx/87	na				23	9.14	450	na	na	4
	09/26/96	na				23	9.1	624	na	na	5
	09/13/00	08:45 AM			production well	23	9.25	441	5.75	pumped	
EH-1 Well	10/xx/83	na	37 47.005	116 45.796		na	na	na	na	na	4
	04/xx/87	na				na	9	327	na	na	4
	08/24/00	05:17 PM			production well, no power						
EH-2 Well	10/xx/83	na	37 46.968	116 46.673		na	na	na	na	na	4
	04/xx/87	na				22	8.14	320	na	na	4
	09/12/00	05:46 PM			production well	22.1	8.13	305	6.34	pumped	
EH-3 Well	08/24/00	na	not found								
EH-4 Well	08/24/00	05:00 PM	37 46.271	116 43.984	monitoring						
Roller Coaster (Sandia #8) Well	12/xx/83	na	37 43.247	116 44.290		na	na	na	na	na	4
	04/xx/87	na				25	7.82	570	na	na	4
	09/26/96	na				26	7.8	513	na	na	5
	09/13/00	09:25 AM			production well	25	7.85	527	6.29	pumped	
Sandia #1 Well	08/24/00	na	not found								
Mellan Well	not visited										
TTR Fire Pit well #1	not visited				monitoring well						
TTR Fire Pit well #2	not visited				monitoring well						
TTR Fire Pit well #3	not visited				monitoring well						
TTR Landfill	not visited				monitoring well						
TTR Landfill	not visited				monitoring well						
Gold Flat											
Cedar Pass (O&M) Well	12/xx/83	na	37 44.791	116 28.990		na	na	na	na	na	4
	04/xx/87	na				27	7.86	290	na	na	4
	09/26/96	na				28	7.7	288	na	na	5
	09/12/00	01:00 PM			production well	28.2	8.03	283	5.3	pumped	

Table C-7 (continued). Field reconnaissance data for wells and mine shafts: location, chemistry, discharge.

Water Source Name	Field Reconnaissance Date	Time	Latitude	Longitude		Chemistry Parameters Temp. (°C)	pH	EC (us/cm)	DO (mg/l)	Discharge Q (lpm)	Ref.
Wells and Mine Shafts (continued)											
Gold Flat (continued)											
Site 4	11/27/90	na				na	na	na	na	na	7
	05/13/92	10:59 AM				29.3	9.18	267	na	na	7
	01/27/93	na				na	na	na	na	na	7
	12/05/00	08:42 AM			production well	28.2	9.11	267	na	pumped	
Gold Flat #1 well site	08/26/00	09:33 AM	37 26.808	116 28.237	casing destroyed						
Gold Flat #2 well	11/25/96	na	37 25.669	116 36.588		18	8	222	na	na	5
	08/26/00	12:04 PM			no power						
Gold Flat #2A well	08/26/00	na	37 25.660	116 36.564	no power						
Salsbury Well	not visited				reported destroyed						
Reveille Valley											
Camp's Well	not visited										
Willow Witch Well	06/15/00	12:06 PM	37 50.495	116 12.520	not accessible						
Kawich Valley											
mine shaft, w of playa	07/10/00	na	37 31.452	116 13.829	not accessible						
well, n edge of large playa	07/13/00	03:59 PM	37 30.241	116 13.286	dry						
Floyd Lamb Well	07/11/00	10:04 AM	37 25.628	116 12.610	dry						
Kawich	12/05/00	na	not found								
Penoyer Valley											
South Western	off range, not visited										
Emigrant Valley											
WT-1	09/18/57	na	37 14.650	115 48.533	production well	25	8	341	nm	na	1
	04/25/58	na				22.8	8.2	342	nm	na	1
	02/08/91	na			no pump, monitoring well	19.7	7.52	264	nm	na	7
	08/16/95	na				34	8.2	308	nm	na	5
WT-2	09/18/57	na	37 14.650	115 48.000	production well	28.9	8.3	412	nm	na	1
	04/25/58	na				27.8	8.5	405	nm	na	1
	02/08/91	na			no pump, monitoring well	nm	nm	nm	nm	na	7
WT-3	11/25/59	na	37 15.650	115 50.050	production well	22.5	7.8	345	nm	na	2
	06/06/91	na				22.7	7.77	385	nm	na	7
	08/15/95	na				23	7.9	425	3	na	5
	11/27/00	11:02 AM				21.8	7.99	385	nm	na	
WT-4	06/13/91	na	37 15.583	115 50.267	production well	33	6.86	880	nm	na	7
	08/15/95	na				25	6.9	1100	0.3	na	5
	12/04/00	01:20 PM				34.1	6.79	802	nm	na	

Table C-7 (continued). Field reconnaissance data for wells and mine shafts: location, chemistry, discharge.

Water Source Name	Date	Time	Field Reconnaissance Latitude	Longitude		Chemistry Parameters Temp. (°C)	pH	EC (us/cm)	DO (mg/l)	Discharge Q (lpm)	Ref.
Wells and Mine Shafts (continued)											
Emigrant Valley (continued)											
89-70 Well	04/12/91	na	37 15.583	115 57.583	monitoring	na	na	na	na	na	7
89-72 Well	06/07/91	na	37 11.550	115 54.833	monitoring	25.5	6.83	1540	nm	na	7
90-70 Well	04/11/91	na	37 12.017	115 58.700	monitoring	18	9.6	5080	nm	na	7
92-70 Well (Stewart Well #1)	03/28/91	na	37 16.600	115 57.867	monitoring	25.5	6.5	1600	nm	na	7
93-68 Well	06/05/91	na	37 18.617	116 01.150	monitoring	26.8	7.64	440	nm	na	7
93-72 Well (Stewart Well #2)	03/xx/91	na	37 18.650	115 55.033	plugged with debris						7
Naquinta Valley	03/xx/91	na	not found								7
Oak Spring Butte	03/xx/91	na	not found								7
Stewart's Wells	03/xx/91	na	not found								7
Stonewall Flat											
Desert Well	06/25/00	08:10 AM	37 36.298	116 57.932	dry						
Civet Cat Canyon Well	06/25/00	09:39 AM	37 32.716	116 51.217	dry						
Ralston Well	off range, not visited										
Sarcobatus Flat											
TPJ-1	off range, not visited										
TPJ-2	off range, not visited										
Pahute Mesa											
Gold Crater area	06/25/00	12:11 PM	37 32.553	116 53.032	no water found						
Franz Hammel Mine	06/25/00	10:29 AM	37 32.473	116 47.354	not accessible						
Yellow Tiger	not visited										
Yellow Tiger	not visited										
Tolicha Peak											
TPECR Well	09/25/96	na	37 18.535	116 47.076	production well	31	8	407	na	na	5
	11/25/96	na				30	7.9	383	na	na	5
	09/14/00	08:00 AM				31.5	7.81	369	5.35	pumped	
Quartz Mt. (Tolicha Peak)											
hand dug, n of Quartz Mountain	08/27/00	03:17 PM	37 16.912	116 44.058	shallow, wet; not sampled						
Oasis Valley											
PM-3	10/12/00		not determined		monitoring	nm	nm	nm	nm	nm	
Stager's	not visited										

Table C-7 (continued). Field reconnaissance data for wells and mine shafts: location, chemistry, discharge.

Water Source Name	Field Reconnaissance Date	Time	Latitude	Longitude		Chemistry Parameters Temp. (°C)	pH	EC (us/cm)	DO (mg/l)	Discharge Q (lpm)	Ref.
Wells and Mine Shafts (continued)											
Mercury Valley											
Army #6A	off range (NTS), not visited										
Army #1	off range (NTS), not visited										
Frenchman Flat											
TW-3	off range (NTS), not visited										
Indian Springs Valley											
MW-21	not visited				monitoring well						
MW-20	not visited				monitoring well						
MW-22	not visited				monitoring well						
TW-10	off range, not visited										
TW-4	off range, not visited										
Indian Springs 3	not visited										
ISAFB Well	06/27/85	na	36 34.783	115 40.783	may be same as ISAFAF well 3	23.5	7.3	1270	3.7	na	6
ISAFAF #62-1 (USAF-1)	10/24/00	02:10 PM	36 34.845	115 40.496	production well	22.4	7.43	704	n/a	pumped	
ISAFAF #106-2 (USAF-2)	10/24/00	08:30 AM	36 34.781	115 40.782	production well	22.7	7.23	1313	8.4	pumped	
ISAFAF Well 3 (USAF Well 3)	10/24/00	02:15 PM	not determined		reserve well, adjacent to ISAFAF #62-1						
Indian Springs USAF-3	off range, not visited				may be same as ISAFAF well 3						
Indian Springs D-12	off range, not visited										
Cactus Springs Well #2	off range, not visited										
Cactus Springs Well #1	off range, not visited										
Cactus Springs Well #3	off range, not visited										
Indian Springs 2	off range, not visited										
Indian Springs D-11	off range, not visited										
Army #2	off range, not visited										
Army #3	off range, not visited										
Three Lakes Valley											
Point Bravo production well	06/23/86	na	36 32.116	115 33.961		25.1	8.7	330	7.2	na	6
	10/24/00	10:25 AM			production well	21.5	7.67	305	9.6	pumped	
Point Bravo back-up	10/24/00	na	36 32.097	115 33.955	reserve well						
Desert Dry Lake Valley											
Desert (Dry) Lake (DDL-1)	03/18/87	na	36 57.193	115 11.858		19	8	400	2.8	na	6
	10/25/00	11:55 AM			locked cap						
Desert Dry Lake #2 (DDL-2)	10/25/00	11:00 AM	36 55.037	115 13.683	dry						

Table C-7 (continued). Field reconnaissance data for wells and mine shafts: location, chemistry, discharge.

Water Source Name	Date	Time	Field Reconnaissance Latitude	Longitude		Chemistry Parameters Temp. (°C)	pH	EC (us/cm)	DO (mg/l)	Discharge Q (lpm)	Ref.
Wells and Mine Shafts (continued)											
Las Vegas Valley											
Cow Camp Well	10/25/00	03:11 PM	36 34.111	115 21.867	monitoring well						
DR-1	10/25/00	04:10 PM	36 33.471	115 24.647	locked cap						
South Black Hills #1	08/05/87	na	36 32.194	115 24.080	monitoring well	29	7.5	400	6.4	na	6
	10/25/00	04:38 PM			locked cap						
Alpha Well #3	12/19/87	na	36 31.583	115 28.217	monitoring well	23	8.1	390	9.2	na	6
Alpha Well #2	12/19/87	na	36 30.75	115 28.083	monitoring well	19	8.1	370	9.3	na	6
Silver Flag Alpha (Alpha Well #1)	12/18/87	na	36 28.527	115 26.945	production well	na	7.8	360	8.7	na	6
	10/24/00	11:45 AM				20	7.7	315	10.18	pumped	
2362-1	not visited										
2278-1	not visited										
2364	not visited										
Corn Creek NAF-63C	off range, not visited										
Corn Creek Well	off range, not visited										
Insufficient information to locate											
Mine Well	not visited										

Notes
nm = not measured
na = information not available
[1] Silverbow Canyon (Breen Crek Marsh): 38 lpm measured at sampled location; 102.7 lpm measured in channel below marsh.
[2] Georges Water: 12.2 lpm measured at the trough at the spring; 75.6 lpm combined flow at all outlets along pipeline from spring.
* discharge points on pipeline from associated spring.
[3] Sumner and Cedar Springs: flow at the two spring orifices could not be measured; measured flow at discharge points on the joint pipeline totaled 41.8 lpm.
[4] Rose Spring: flow at the orifice could not be measured; flow at the end of the pipeline, the only flowing discharge point, was measured at 7.5 lpm.

References

1. Moore, JE. 1961. Records of Wells, Test Holes, and Springs in the Nevada Test Site and Surround Area. TEI-781, prepared on behalf of the US Atomic Energy Commission by the US geological Survey, Denver, Colorado.
2. Schoff, SL. 1962. Pumping Test and Other Data on Well Watertown 3, Lincoln County, Nevada. Techincal Letter NTS-33, US Geological Survey, Denver Colorado.
3. USAF. 1985. Draft Environmental Impact Statement, Groom Mountain Range, Lincoln County, Nevada.
4. USAF. 1988. Final Environmental Impact Statement, Tonopah Test Range Area 10, Nye County, Nevada.
5. Rose, TP, JM Kenneally, DK Smith, ML Davisson, GB Hudson, and JH Rego. 1997. Chemical and Isotopic Data for Groundwater in Southern Nevada, UCRL-ID-128000, Lawrence Livermore National Laboratory, Livermore, California.
6. Thomas, JM, BF Lyles, LA Carpenter. 1991. Chemical and Isotopic Data for Water from Wells, Springs, and Streams in Carbonate-Rock Terrane of Southern and Eastern Nevada and Southeastern California, 1985-88. Open-File Report 89-422, US Geological Survey, Nevada District Office, Carson City.
7. USAF unpublished data.data.

APPENDIX D

Bat species known to occur in Nevada

Table D-1. Bat species known to occur in Nevada.

Species	Status	Distribution	Habitat	Roost
Mexican long-tongue *Choeronycteris mexicana*	SOC	Migrant. Southwest United States, south to Venezuela. Primarily from southeastern Arizona and southwestern New Mexico. Considered a vagrant in Nevada.	Foothills and mountains. Water sources and suitable foraging areas near roots are vital. Foothills and mountains with arid thorn scrub, oak, pine woodland, and pine-fir zone. Critical habitat includes riparian canyons with night-blooming food plants. Nectar feeder.	Abandoned mine tunnel or caves are preferred. Summer roost may include mines, caves, rock crevices, and occasionally buildings.
California leaf-nosed *Macrotus californicus*	SOC	Year-long. Southwest United States, Mexico, and Caribbean. Spring Mountains are the northern boundary for the distribution of the California leaf-nosed bat.	Low elevation Sonoran and Mojave Desert scrub. Critical habitat includes abandoned mines, geothermically altered mines, and vegetated areas near roots where they glean insects from leaf surfaces.	Primarily caves and mines. At locations with winter temperatures of 9-12°C roots may be in geothermally heated mines. Day roots are often in abandoned mines tunnels while night roots may be mines, open buildings, bridges or rock shelters. Colonial, up to several hundred.
Southwestern cave myotis *Myotis velifer brevis*	SOC	Summer migrant. Southern Nevada, southeastern California, and general southwest to Honduras.	Near water in desert scrub of creosotebush, palo verde, and cacti. Occasional in oak-pine forest. They Forage just above the vegetation. Require forage sites near roots.	Primarily short mines and caves, but also cliff and barn swallow nests, under bridges, and in buildings up to the 1,515 (5,000 ft) elevation contour. Colonial and roots in clusters near openings. Maternity roosts may include thousands of females and young.
Spotted *Euderma maculatum*	SOC	Apparent summer migrant in S. Nevada. Western North America from British Colombia to Mexico. Most frequent in California, Arizona, New Mexico, and Utah, but also the Nevada Test Site and Las Vegas area	All habitats from semi-arid desert scrub to pine forests. Regularly associated with high cliffs, canyons, and riparian areas. Solitary air-borne forager of insects.	During summer roost singly in crevices and cracks in canyon and cliff walls. Characteristics and localities are poorly known. Solitary.

Greater western mastiff *Eumops perotis californicus*	SOC	Southern California, southern Nevada, southern Arizona, west Texas, and Northern Mexico. Spring Mountains appear to be northern boundary of distribution. Year-long residents in Arizona, probably migratory in other locations.	Typically at elevations of 1,212 m (4,000 ft) or less in lower and upper Sonoran and lower Mojave desert scrub in rocky canyons and cliffs with abundant crevices. Critical habitat is locations with rugged rocky canyons, cliffs with many crevices, and large water pools. Large size precludes us of small pools.	Generally roost in crevices and shallow caves on the sides of vertical cliffs and rock walls. Periodically use abandoned buildings. Multiple roots necessary to meet temperature requirements. Preferred crevices are horizontal but face downward. Must be unobstructed and 3+ m above ground surface. Primarily roosts during day, not night, due to long foraging bouts. Most roosts are 3+ m deep. May roost singly or in colonies.
Western small footed myotis *Myotis ciliolabrum leibii*	SOC	Western North America: British Columbia to Mexico, and the Pacific States through the Midwest and Northeast States. Found throughout Nevada.	In or near forested areas: oaks, junipers, chaparral. Most probable at water sites situated in forests or woodlands.	Caves, mines, tunnels, crevices in rocks, buildings, and behind loose bark in trees. Colonial or solitary.
Yuma myotis *Myotis yumanensis*	SOC	Western North America from British Columbia to Mexico. West Coast to the western plains. Summer migrant that winters in Mexico. In Nevada only known from Clark County along the California border.	Common in desert areas, but periodically captured in pine woodlands. Usually associated with permanent streams, canals, and ponds. Forages over land and water; opportunistic consumer of aquatic insects.	Cliff crevices, mines, caves, buildings, and abandoned cliff - swallow nests. Colonial.
Long-legged myotis *Myotis volans*	SOC	Western North America. British Columbia to Mexico and Pacific States to the western Great Plains.	Most common in Ponderosa Pine and coniferous forests, but also PJ with oak and blackbrush. Forages over water and in forest openings.	Buildings, crevices, in rock ledges, hollow trees. Colonial.
Fringed myotis *Myotis thysanodes*	SOC	Western North America: Eastern Washington and southern Idaho south to Mexico. Found statewide in Nevada.	Low to mid elevation woodlands including the ponderosa pine forest. Can be expected at water sites.	Caves, attics, of old buildings, mines, and rock crevices. Transient use of night roosts. Colonial.

Long-eared myotis *Myotis evotis*	SOC	Western North America, from central British Columbia, Alberta, and Saskatchewan, south to New Mexico, Arizona, California, and Baja, Mexico. Found throughout Nevada.	Mid to high elevation habitats in the pinyon-juniper, ponderosa pine and spruce-fir zones.	Buildings, beneath bark; in snags, and in mines and caves. Females in maternity colonies from mid-June through early July. Colonial or solitary.
Townsend's big eared *Corynorhinnus townsendii*	SOC	Year-round in Nevada. Much of Western North America from British Columbia, southern Montana, South Dakota south to Texas to northeastern Mexico.	Primarily in arid, western desert scrub, pinyon-juniper habitats, and coniferous habitats. Roosts are most critical habitat feature.	Daytime: principally mine tunnels and caves. Nighttime: abandoned buildings. Do not use cracks and crevices. Colonial
Big free-tailed *Nyctinomops macrotis*	SOC	Southern and eastern Nevada; southern Utah and southern California; Arizona; New Mexico; west Texas; and Mexico. There are no known populations in Southern Nevada. The few occurrences are probably accidental.	Low to high elevations (0-2,600 m). Primarily in rugged, rocky, regions. May require large bodies of water from which to drink.	Caves, crevices in cliffs, and buildings.
Allens brown *Idionycteris phyllotis*	SOC	Extreme southern Nevada and southern Utah; Arizona and Mexico. Only known from the southern counties of Nevada.	Found from desert scrub to pine fir, with pinyon-juniper and ponderosa pine being the most common community types. Usually near rocky slopes and cliffs (probable roost sites). Often netted along water courses and/or ponds.	Caves, mines, and crevices in cliffs. Colonial.
California myotis *Myotis califonricus*	None	Pacific states east to Idaho and eastern Colorado, and south to north west Mexico.	Forages near trees, usually less than 15 ft above the ground.	Mines, hollow trees, loose rocks, buildings, and bridges. Largely a crevice dweller.
Little brown *Myotis lucifugus*	None	All states except Florida, south/southeast California, extreme southern Nevada, and Texas south of the panhandle.	Feeds on insects near water or forests.	Caves, mine tunnels, hollow trees, and buildings. Colonial

Small footed *Myotis subulatus*	None	Most of western North America, the central Midwest, and the north eastern states.	In or near forested areas	Caves, mine tunnels, crevices in rocks, buildings.
Silver haired *Lasionycteris noctivagans*	None	Most states except Florida and southwest California. Probably migratory in winter.	Forested areas with water. Selects sites with less canopy closure, less understory, and shorter statured understory.	Buildings; occasional caves; behind exfoliating bark and in cavities in pine trees. Colonial and solitary.
Western pipistrel *Pipistrellus hesperus*	None	California; southwest states; Great Basin; and Columbia Plateau.	Arid locations near water sources	Caves, under rocks; crevices in cliffs.
Red *Lasiurus borealis*	None	Most of North America except rocky mountains and northern Great Basin. Migrant	Wooded locations.	Trees, occasional caves, Solitary.
Big brown *Eptesicus fuscus*	None	North America, except Florida	Wooded areas.	Caves, tunnels, crevices, hollow trees, and buildings. Mostly solitary but also small clusters.
Hoary *Lasiurus cinereus*	None	North America except southern Florida. Migrates south.	Wooded areas.	Trees; occasional caves.
Mexican big-eared *Plecotus phyllotis*	None	Southern Nevada; southern Utah; Arizona and Mexico.	Oak and/or pine forests	Caves
Pallid *Antrozous pallidus*	None	California; eastern Oregon and Washington; Great Basin; southwest states; western California; western Texas; and Mexico.		Caves, tunnels, crevices in rocks, buildings, and trees. Colonial

Table developed from data and information in Burt and Grossenheider1980, Hunz and Martin 1982, Leonard and Fenton 1983, Bell et al. 1986, Brigham et al. 1992, Whitaker and Gummer 1992.Whitaker and Lawhead. 1992, Ramsey 1994, Mattson et al. 1996, Ports and Bradley 1996, Warner and Czaplweski 1984. Ramsey 1997.

THIS PAGE DELIBERATELY LEFT BLANK

APPENDIX E

Habitat Requirements
for
Threatened, Endangered, and Candidate Plant Species, and SOC
Found on and near the NTTR

Table E-1 Habitat requirements for threatened, endangered, and candidate plant species, and SOC found on and near the NTTR.

Species	Plant Community	Flowering Period	Elevation Range (m)	Parent Material	Landform	Soil Characteristics
Arctomecon merriamii	Mojave Desert: *Larrea-Ambrosia, Atriplex; Coleogyne*	April-May	670-1465	Limestone	mountain slopes, Occassional valleys	Shallow, loose gravelly
Asclepias eastwoodiana	Great Basin; Mojave Desert Transition: *Atriplex; Sarcobatus*	May-June	1380-2105		Clay hills; shallow gravelly drainages	Alkaline; shallow; gravelly to clay
Astragalus aequalis	Juniper; Ponderosa pine; *Cercocarpus; Artemisia*	May-June	1798-2560	Limestone	Dry hills and ridges	Gravelly; calcareous
Astragalus amphioxys var. *musimonum*	Mojave Desert: A*triplex; Coleogyne*; scattered pinyon-juniper	April-June	1340-1920	Limestone	Bajadas; gentle slopes; plains; *m*disturbed areas	Gravelly; calcareousus
Astragalus beatleyae	Great Basin: flatrock areas with scattered pinyon/juniper or *Artemisia nova*	May-June	1705-2073	Volcanic	Mesas with exposed masses of flatrock	Very shallow, gravelly
Astragalus eurylobus	Shadscale desert and grassland	April-June	1300-1900		Washes; gullied hills	Gravelly
Astragalus funereus	Mojave Desert: *Atriplex, Coleogyne; Hymenochlea;* scattered Pinyon-Juniper	March-May	980-2290	Mostly volcanic; occasional limestone	Unstable steep slopes; rock crevices; canyon walls; clay ridges openings; abandoned dirt roads	Shallow gravelly
Astragalus gilmanii	Great Basin; Mixed Mojave transition; *Lycium; Ephedra; Yucca; Atriplex Artemisia to Pinus/Juniperus*	June-July	1615-3050	Limestone; volcanics	Hillsides; canyons	Rocky; gravelly
Astragalus mohavensis	*Larrea;* Hot Desert Juniper	April-June	1037-1709	Limestone	Rocky slopes and cliffs	Rocky, gravelly, shallow
Astragalus oophorus var. *lonchocalyx*	Great Basin: Pinyon-juniper, *Artemisia* to *Pinus/Juniperus*	May-June	1830-2590	Limestone	Gravelly hillsides; stony flats	Gravelly to stony; probably calcareous
Astragalus oophorus var. *clokeyanus*	*Pinus*: Open pinyon to ponderosa with Cercocarpus		1900-2740	Limestone	Open slopes to ridges	Gravelly, moist to dry
Astragalus remotus	*Coleogyne; Juniperus; Larrea; Pinus Ponderosa; Quercus*	April-June	1219-1829	Limestone; sandstone	Canyons: rocky hillsides	Gravelly; coarse; regularly disturbed
Astragalus uncialis	Great Basin Salt Desert Shrub: *Atriplex; Sarcobatus; Artemisia Kochia*	May	1615-1845	Limestone	Knolls; slopes	Saline sand and gravel
Camissonia megalantha	Mojave Desert:	June-October	610-2130	Light colored volcanics	Unstable loose substrates washes, talus slopes; and disturbed areas	Loose sandy; alkaline

Table E-1 (continued). Habitat requirements for threatened, endangered, and candidate plant species, and SOC found on and near the NTTR

Species	Plant Community	Flowering Period	Elevation Range (m)	Parent Material	Landform	Soil Characteristics
Castilleja martinii var. *clokeyi*	*Artemisia; Cercocarpus; Pinus; Populus*; pinyon-juniper	June-August	1890-1981	Limestone; volcanics	Mountain slopes	Gravelly, dry
Chrysothamnus eremobius	*Artemisia; Coleogyne; Cercocarpus; Ephedra*	September-October	> 1524	Limestone	Cliffs	Shallow to none
Cryptantha welshii	*Artemisia; Frasera; Chrysothamnus;* Lepidium; Phlox; Leptodactylon.	May	1494-1981	Volcanic	Mounds on alluvial fans and plains	White tufaceous deposits
Cymopterus ripleyi var. *saniculoides*	Mojave and Great Basin: *Atriplex; Larrea; Coleogyne; Artemisia*	April-June	975-2042	Non-specific	Alluvial plains	Deep sandy
Epilobium nevadense	Pinyon; ponderosa pine; *Castillega*	July-September	2271-2804	Limestone	Talus slopes; rock outcrops	Rocky; shallow
Erigeron ovinus	Great Basin: Pinyon; Ponderosa Pine; *Cercocarpus; Abies*	June	1890-2560	Limestone	Rock outcrops, cliffs	Shallow; gravelly to rocky
Frasera gypsicola	*Artemisia; Stanleya*	June-July	1509-1584	Lakebed sediments	Old lakebeds	Fine saline, mineralized clay
Frasera pahutensis	Great Basin: Pinyon; Juniper; *Artemisia; Purshia*	May to July	2195-2410	Volcanic	Mountain slopes and valley bottoms	Gravelly
Galium hilendiae ssp. *kingstonense*	Great Basin *Pinus-Juniperus*	May-June	1680-1980	Volcanics	Ravines; gullies; usually on steep slopes	Loose and rocky
Glossopetalon clokeyi	*Artemisia;* pinyon-juniper	May-June	1219-1981	Limestone	Cliffs	
Jamesia tetrapetala	Pinyon-juniper	May-June	1524+			
Lewisia maguirei	Great Basin: Pinyon-juniper; *Artemisia*	June	2285-2380	Limestone	Scree slopes	Loose denuded
Oryctes nevadensis	Great Basin Salt Desert Shrub: *Atriplex; Oryzopsis; Sarcobatus*	April-June	1190-1524		Hill slopes; foothills; dunes	Sandy

Table E-1 (continued). Habitat requirements for threatened, endangered, and candidate plant species, and SOC found on and near the NTTR

Species	Plant Community	Flowering Period	Elevation Range (m)	Parent Material	Landform	Soil Characteristics
Penstemon arenarius	Great Basin: *Atriplex canescens; Sarcobatus; Oryzopsis; Tetradymia Psorothamnus*	May-June	1215-1340	Volcanic	Generally flats	Deep sandy; sometimes with pavement
Penstemon bicolor ssp. *roseus*	*Larrea*	May-June	610-1677		Washes	Gravelly
Penstemon fruticiformis ssp. *amargosae*	Mojave Desert: *Larrea-Ambrosia; Coleogyne; Atriplex confertifolia*	April-June	1005-1585		Washes	Sandy to gravelly
Penstemon pahutensis	Great Basin: Pinyon-juniper; *Artemisia*	June-July	1770-2285	Volcanic	Mesas	Loose rocky area; disturbed sites
Penstemon pudicus	Great Basin: Pinyon-juniper; *Cercocarpus; Artemisia*	June-July	2320-2805	Volcanic	Steep Mountain sideslopes; ridges; washes	
Phacelia beatleyae	Mojave Desert: *Larrea-ambrosia; Coleogyne*	April-May	1065-1770	Volcanic	Washes and canyons to loose talus; steep barren slopes	Gravel; talus
Porophyllum pygmaeum	*Atriplex confertifolia; Coleogyne*	April-May	914-1219	Limestone: Dolomite	Concave drainages and adjacent slopes	Gravelly
Salvia dorrii var. *clokeyi*	Alpine meadows	May-July	1829-2743	Limestone	Rock outcrops	Dry open sandy/gravelly
Salvia funerea	*Larrea*; *Ambrosia*; *Atriplex*; *Echinocactus*	April -June	2600-3500	Limestone	Rock cliffs, canyon slopes; washess	Shallow, gravelly
Sclerocactus blainei	*Artemisia; Atriplex; Sarcobatus; Chrysothamnus*	May-June	1067-1372	Limestone or volcanic	Alluvial fans	
Sclerocacuts schlesseri	*Artemisia*	May-June	914	Limestone; volcanic	Alluvial fans, plains	Sand with cryptobiotic crusts
Selaginella utahensis	*Arctostaphylos; Quercus*		1524-2439	Sandstone	Cliffs; ledges	Crevices, shallow
Silene nachlingerae	*Pinus-Juniperus*	August September	>1829	Limestone	Rocky peaks; mountain slopes	Shallow
Sphaeralcea caespitosa	Great Basin Salt Desert Shrub: *Atriplex confertifolia; Pleuraphis; Ephedra; Kochia*	May-June	1525-1980	Limestone	Alluvial fans/plains	Usually gravelly, occasionally sandy

Table E-1 (continued). Habitat requirements for threatened, endangered, and candidate plant species, and SOC found on and near the NTTR.

Species	Plant Community	Flowering Period	Elevation Range (m)	Parent Material	Landform	Soil Characteristics
Smelowskia holmgrenii	*Holodiscus*; *Senecio canus*; *Erigeron ribes*	June-August	6500-11000	Calcareous rocks	Talus slopes; rock crevices	Rocky; shallow; Schist
Townsendia jonesii var *tumulosa*	Great Basin: Pinus; *Juniperus; Cercocarpus; Artemisia nova*	June-August	1980-3050	Limestone	Ridges; slopes; saddles; washes; open exposed sites	Loose sandy
Trifolium andinum var. *podocephalum*	*Artemisia; Cercocarpus;* Pinyon	May-July	1372-2256	Volcanic or limestone	Hilltops; ridges; bluffs	Dry, gravelly to rocky
Trifolium macilentum var *rollinsii*	Pinyon-juniper	May-July	2700-3000		Talus hillsides; flats; moist meadows	Gravelly-rocky clay

Table developed from data in: Keck 1937, Munz 1963 Unknown 1964a, b; Dempster and Ehrenforfer 1965; Raven 1969; Reveal 1970, Holmgren 1971, Reveal 1971; Reveal and Beatley 1971, Reveal and Constance 1972, Beatley 1976, Barneby 1980, Mozingo and Williams 1980, Ackerman 1981, Thorne and Higgins 1982, Anderson 1983, Welsh and Thorne 1985, Heil and Welsh 1986, Kartesz 1987, Keil and Morefield 1989, Hickman 1993, Knight and Smith 1994, Knight and Smith 1995, Nachlinger and Combs 1996, Knight et al. 1997.

THIS PAGE DELIBERATELY LEFT BLANK

GLOSSARY

GLOSSARY

ACRE-FOOT: The volume of water that will cover an acre of land to a depth of one foot (323,851 gallons or 43,560 cubic feet).

ACTIVITY PLAN: A detailed, specific plan for management of a single resource program or plan element undertaken as necessary to implement the more general resource management plan decisions.

ADVERSE EFFECT (Cultural Resources): Alteration of the characteristics which contribute to the use(s) determine appropriate for a cultural resource or which qualify a cultural resource property for the *National Register of Historic Places* to such a degree that the appropriate use(s) are reduced or precluded, or the cultural property is disqualified from *National Register of Historic Places* eligibility. Criteria in the regulations of the Advisory Council on Historic Preservation (36 CFR Part 800) guide the process for making the determination of effect.

AIR POLLUTION: Accumulation of aerial wastes beyond the concentrations that the atmosphere can absorb and which may, in turn, damage the environment.

AIR QUALITY CLASSES: Classes established by the Environmental Protection Agency (EPA) that define the amount of air pollution considered significant within an area:

I: Almost any change in air quality would be considered significant.
II: Deterioration normally accompanying moderate, well-controlled growth would be considered insignificant.
III. Deterioration up to the national standards would be considered insignificant.

ALCOVE: A small rock shelter.

ALL-TERRAIN VEHICLE: Any motorized off-highway vehicle 50 inches or less in width, having an unladen dry weight of 600 pounds or less. The vehicle also has three or more low-pressure tires, handle bars for steering control, and a seat designed to be straddled by the operator.

ALL-TERRAIN BICYCLE: A bicycle equipped for both street riding and off-road trail riding.

ALLOTMENT: An area allocated for the use of the livestock or one or more qualified grazing permittees or lessees which includes prescribed numbers and kinds of livestock under one plan of management.

ALLOTMENT MANAGEMENT PLAN: A documented program which applies to livestock operations on the public lands, which is prepared in consultation with the permittee (s) or lessees involved, and which : 1) prescribes the manner in which livestock operations will be conducted in order to meet the multiple-use, sustained yield, economic, and other needs and objectives as determined for the public lands through land use planning.

ALLUVIAL FAN: A fan-shaped accumulation of disintegrated soil material; water deposited and located in a position where the water departs from a steep course to enter upon a flat plain or open valley bottom.

ALLUVIUM: Material, including clay, silt, sand, gravel, or similar unconsolidated sediments, deposited by a stream bed or other body of running water.

AMBIENT AIR QUALITY: Prevailing condition of the atmosphere at a given time; the outside air.

ANIMAL UNIT MONTH (AUM): The amount of food or forage required by an animal unit (one cow or five sheep) for 1 month.

ANNUAL PLANT SPECIES: A plant that completes its life cycle and dies in 1 year or less.

APPARENT TREND: An interpretation of the direction of change in vegetation and soil protection over time, based on a single observation. Apparent trend is described in the same terms as measured trend except that when no trend is apparent, it shall be described as none.**AQUIFER:** A water-bearing unit of permeable rock or sediment which is capable of yielding water to wells.

APPROPRIATE MANAGEMENT LEVEL (AML): The number of wild horses and burros suitable for a herd management area as determined through BLM's planning process and evaluation of monitoring data.

AQUIFER: A formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield economical quantities of water to wells and springs.

ARCHAIC PERIOD: An archeological period of about 8,000 years ago, and continuing to aabout A.D. 500.

ARCHEOLOGICAL DISTRICT: An area that provides a concentration of cultural properties in a discrete, definable location.

AREA OF CRITICAL ENVIRONMENTAL CONCERN: Areas within the public land where special management attention is needed to protect and prevent irreparable damage to important historical, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect life and safety from natural hazards.

ASPECT SPECIES: A vegetation species that appears to be dominant in the landscape, although it may be only a small percent of the total vegetation composition.

BASE PROPERTY: Lands or water sources on a ranch that are owned by or under long-term control of the operator.

BIOMASS: The total quantity of living organisms of one or more species per unit of space (called species biomass) or of all the species in a community (called community biomass).

BROWSE: (noun) That part of leaf and twig growth of shrubs, woody vines, and trees available for animal consumption. (verb) To consume browse.

BROWSERS: Animals which feed primarily on browse.

CALICHE: A layer in the soil more or less cemented by calcium carbonates (CaCo3), commonly found in arid and semiarid regions.

CAMPSITE: A cultural site type representative of all periods consisting of temporary habitation areas which usually contain a lithic scatter, evidence of fire use, ground stone, and pottery scatter.

CANDIDATE SPECIES: Any species of plant or animal listed in the for consideration to be listed as threatened or endangered by U.S. Fish and Wildlife Services (USFWS) under the Endangered Species Act. Definitions for Categories 1 and 2 candidate species, excerpted from the *Federal Register*, are as follows:

Category 1: Taxa for which the USFWS currently has on file substantial information on biological vulnerability and threat(s) to support the appropriateness of proposing to list them as endangered or threatened species. Presently, data are being gathered concerning precise habitat needs, and for some of the taxa, concerning the precise boundaries for critical habitat designations. Development and publication of proposed rules on these taxa are anticipated, but, because of the large number of such taxa, could take some years. Also included in category 1 are taxa whose status in the recent past is known, but that may already have become extinct.

Category 2: Taxa for which information now in possession of the USFWS indicates that proposing to list them as endangered or threatened species is possibly appropriate, but for which substantial data on biological vulnerability and threat(s) are not currently known or on file to support the immediate preparation of rules. Further biological research and field study usually will be necessary to ascertain the status of the taxa in Category 2, and some of the taxa are of uncertain taxonomic validity. It is likely that some of the taxa will not warrant listing, while others will be found to be in greater danger of extinction than some taxa in category 1.

CARRYING CAPACITY: Maximum stocking rate possible without inducing damage to vegetation or related resources. It may vary from year-to-year on the same area due to fluctuating weather conditions and forage production. (See Grazing capacity.)

CAVE: Any naturally occurring void, cavity, recess, or system of interconnected passages which occurs beneath the surface of the earth or within a cliff or ledge (including any cave resource therein, but not including any vug, mine, tunnel, aqueduct, or other manmade excavation) and which is large enough to permit an individual to enter, whether or not the entrance is naturally formed or manmade. Such term shall include any natural pit, sinkhole, or other feature which is an extension of the entrance.

CLAY: A mineral soil separate consisting of particles less than 0.002 millimeters in equivalent diameter.

CLIMAX VEGETATION COMMUNITY: The final or stable community in a series of successive vegetation states which is self-perpetuating and in dynamic balance with the physical and biotic environment.

COMMUNITY: A group of plants and animals living together in a common area and having close interactions.

CONTRAST (VISUAL): The effect of a striking difference in the form, line, color, or texture of an area being viewed.

CONTRAST RATING: A method of determining the extent of visual impact of an existing or proposed activity that will modify any landscape feature.

COORDINATED RESOURCE MANAGEMENT PLAN: A plan for management of one or more allotments that involves all the affected resources, e.g. range, wildlife, and watershed.

COVER: Small rocks, litter, basal areas of grass and forbs, and aerial coverage of shrubs that provide protection to the soil surface (i.e. in contrast to bare ground.)

CRITICAL SOILS: Soils that (1) contain very highly saline soils and/or (2) are very susceptible to water erosion.

CRITICAL WATERSHED: An area of soils that (1) have a high potential for salt yield; (2) are subject to severe water and wind erosion when disturbed; (3) have high runoff potential during storm events; (4) are subject to frequent flooding; or (5) have a potential for loss of vegetation productivity under high rates of wind and water erosion.

CRITICAL WILDLIFE HABITAT: Is defined in the Endangered Species Act as follows (i) The specific areas within the geographical area occupied by an animal species at the time it is listed in accordance with the provisions of section 4 of this Act on which are found those physical or biological features (I) essential to the conservation of the species and (II) which may require special management considerations or protection; and (ii) specific area outside the geographical area occupied by the species at the time it is listed in accordance with the provisions of section 4 of this Act, upon a determination by the Secretary that such areas are essential for the conservation of the species.

CRUCIAL WILDLIFE HABITAT: Sensitive use areas that are necessary to the existence, perpetuation, or introduction of one or more species during critical periods of their life cycles.

CULTURAL PROPERTY: Any definite location of past human activity, habitation or use identified through a field inventory (see below), historical documentation or oral evidence. This term may include (1) archeological or historic sites, structures and places, and (2) sites or places of traditional cultural or religious importance to a specific group, whether or not represented by physical remains. Cultural properties are managed by the system of inventory evaluation, protection, and use.

CULTURAL RESOURCES: Those fragile and non-renewable remains of human activities, occupations, and endeavors as reflected in sites, buildings, structures, or objects, including works of art, architecture, and engineering. Cultural resources are commonly discussed as prehistoric and historic values, but each period represents a part of the full continuum of cultural values from the earliest to the most recent.

CULTURAL RESOURCE INVENTORY CLASSES: BLM 8100 Manual provides through classes of inventory.

Class I is an Existing Date Inventory: an inventory study of a defined area designed to provide a narrative overview (cultural resource overview) derived from existing cultural resource information and to provide a compilation of existing cultural resource site record data on which to base the development of BLM's site record system.

Class II is a Sampling Field Inventory designed to locate and record, from surface and exposed profile indications, all cultural resource sites within a portion of a defined area in a manner which will allow an objective estimate of the nature and distribution of cultural resources in the entire defined area. The Class II inventory is a tool utilized in management and planning activities as an accurate predictor of cultural resources in the area of consideration. The primary area of consideration for the implementation of a Class II inventory is a planning unit. The secondary area is a specific project in which an intensive field inventory (Class III) is not practical or necessary.

Class III is an intensive field inventory designed to locate and record, from surface and exposed profile indications, all cultural resource sites within a specified area. The acceptable form to conduct this survey is for a qualified

archaeologist to walk transects with a maximum interval of 100 feet. The inventory is used to identify any resources that may qualify for nomination to the *National Register of Historic Place*s. Normally, upon completion of such inventories in an area, no further cultural resource inventory work is needed. A Class III inventory is appropriate on small project areas, all areas to be disturbed, and primary cultural resource areas.

CULTURAL SITE: A physical location of past human activities or events. Cultural resource sites are extremely variable in size and range from the location of a single cultural resource object to a cluster of cultural resource structures with associated objects and features. Prehistoric and historic sites which are recorded as cultural resources have sociocultural or scientific values and meet criterion of being more than 50 years old.

DESERT PAVEMENT: A natural, residual concentration of wind-polished, closely packed pebbles, boulders, and other rock fragments, mantling a desert surface where wind action and sheetwash have removed all smaller particles. It usually protects the underlying, finer-grained material from further deflation. The coarse fragments commonly are cemented by mineral matter.

DESIRED PLANT COMMUNITY: The plant community that has been determined through a land use or managementn plan to best meet the plan's objectives for a site. A real documented plant community that embodies the resource attributes for the present or potential use of an area, the desired plant community is consistent with the site's capability to produce the required resource attributes through natural succession, managementn intervention, or a combination of both.

DIVERSITY: An attribute of an area which is an expression of both the total number and relative abundance of species, communities, or habitats. Relative abundance can be measured by numbers of individuals, cover, or various other characteristics.

EARLY SERAL STAGE: A plant community with a species composition which is 0-25% of the potential natural community one would expect to find on that ecological site.

ECOLOGICAL SITE: A kind of land with a specific potential natural community and physical site characteristics differing from other kinds of land in its ability to produce vegetation and to respond to management.

ECOLOGICAL STATUS: The present state of vegetation and soil protection of an ecological site in relation to the potential natural community for the site. Vegetation status is the expression of the relative degree to which the kinds, proportions, and amounts of plants in a community resemble that of the potential natural community. If classes are used, they should be described in ecological rather than utilitarian terms. Soil status is a measure of present vegetation and litter cover relative to the amount of cover needed on the site to prevent accelerated erosion.

ECONOMIC IMPACT: The change, positive or negative, in economic conditions (including distribution and stability of employment and income in affected local and regional economies) that directly or indirectly result from an activity, project, or program.

ECOSYSTEM: A complex self-sustaining natural system which includes living and nonliving components of the environment and the circulation of matter and energy between organisms and their environment.

ECOSYSTEM MANAGEMENT: The skillful use of ecological, economic, social, and managerial principles in managing ecosystems to produce, restore, or sustain ecosystem integrity and desired conditions, uses, products, values and services over the long term. Also, a process of land and resource management that emphasizes the care and stewardship of an area to ensure that human

activities will be carried out to proctect natural processes, natural biodiversity, and ecological integrity.

ENDANGERED SPECIES: An animal or plant whose prospects for survival and reproduction are in immediate jeopardy, and as further defined by the Endangered Species Act of 1973.

ENVIRONMENTAL ASSESSMENT (EA): A concise public document for which a Federal agency is responsible that serves to: (a) briefly provide sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a finding of no significant impact; (b) aid an agency's compliance with the National Environmental Policy Act (NEPA) when no environmental impact statement is necessary; (c) facilitate preparation of a statement when one is necessary. An EA includes brief discussions of the need for the proposal, of alternatives as required by Sec. 102 (2) of NEPA, of the environmental impacts of the proposed action and other alternatives, and a listing of agencies and persons consulted.

ENVIRONMENTAL CONSEQUENCE: A temporal or spatial change in the human environment caused by an act of man. The change should be (1) perceptible, (2) measurable, and (3) relatable through a change agent to a proposed action or alternative. A consequence is something that follows an antecedent (as a cause or agent). Consequences are synonymous with impacts and effects.

ENVIRONMENTAL IMPACT STATEMENT (EIS): A written analysis of the impacts on the environment of a proposed project or resource management plan.

EPHEMERAL RANGE: A rangeland that does not consistently produce enough forage to sustain a livestock operation but may briefly produce unusual volumes of forage to accommodate livestock grazing.

EROSION: The wearing away of land surface by wind, running water, and other geological agents.

EVALUATION (Cultural Resources): The analysis of cultural resource inventory records, the application of professional judgement to identify characteristics that contribute to possible uses for recorded cultural resources, and the recommendation of appropriate use(s) for each resource or group of resources. National Register eligibility criteria, 36 CFR Part 60, are interpreted through or with reference to BLM evaluation criteria.

EXOTIC SPECIES: A species which is not native to the United States.

FEDERAL LAND: Land owned by the United States, without reference to how the land was acquired or which federal
agency administers the land, including mineral or coal estates underlying private surface.

FEDERAL LAND POLICY AND MANAGEMENT ACT OF 1976 (FLPMA): Public Law 94-579, which gives the BLM legal authority to establish public land policy, to establish guidelines for administering such policy and to provide for the management, protection, development and enhancement of the public land.

FIRE MANAGEMENT: The integration of fire protection, prescribed burning, and fire ecology knowledge into multiple use planning, decision making, and land management activities.

FORAGE: All browse and herbaceous foods available to grazing animals.

FORAGE UTILIZATION: An index of the extent to which forage is used. Utilization classes range from slight (less than 20 percent) to severe (more than 80 percent).

FORB: Any herbaceous nonwoody plant that is not grass or grass-like.

GRASS: Any of a family of plants with narrow leaves, jointed stems, and seed- like fruit.

GRAZING PREFERENCE: The total number of AUMS of livestock grazing on public lands apportioned and attached to base property owned or controlled by a permittee or lessee. Active preference combined with suspended non-use make up total grazing preference.

GROUND WATER: Water beneath the land surface, in the zone of saturation.

GULLY EROSION: Removal of soil leading to formation of relatively large channels or gullies cut into the soil by concentrations of runoff.

HABITAT: A specific set of physical conditions that surround the single species, a group of species, or a large community. In wildlife management, the major components of habitat are considered to be food, water, cover, and living space.

HABITAT MANAGEMENT PLAN (HMP): A written and officially approved plan for a specific geographical area of public land which identifies wildlife habitat and related objectives, establishes the sequence of actions for achieving objectives, and outlines procedures for evaluating accomplishments.

HAZARDOUS WASTE OR MATERIAL (HAZMAT): Any substance that poses a threat to the health or safety of persons or the environment. These include any material that is toxic, ignitable, corrosive, or radioactive.

HEAVY USE: Indicates that 60-80 percent of current year's forage production has been eaten or destroyed by grazing animals.

HERD MANAGEMENT AREA PLAN (HMAP): A written and officially approved plan for a specific geographical area of public land which identifies wild horse (or burro) herd use areas and habitat, identifies population and habitat objectives, establishes the sequence of actions for achieving objectives, and outlines procedures for evaluating accomplishments.

HISTORICAL CULTURAL RESOURCES: Historical cultural resources include all mines, ranches, towns, resorts, railroads, trails, and other evidence of human use from the time of the entrance of the Europeans to 1938.

KARST: A type of topography that results from dissolution and collapse of limestone, dolomite, or gypsum beds and is characterized by closed depressions or sinkholes, caves, and underground drainage.

KEY FORAGE SPECIES: Forage species whose use serves an indicator of the degree of use of associated species.

LAND DISPOSAL: A transaction that leads to the transfer of title of public lands from the federal government.

LATE SERAL: A plant community with a species composition which is 51-75% of the potential natural community one would expect to find on that ecological site.

LEASABLE MINERALS: Minerals such as coal, oil shale, oil and gas, phosphate, potash, sodium, geothermal resources, and all other minerals that may be acquired under the Mineral Leasing Act of 1920, as amended.

LIMESTONE: A sedimentary rock consisting chiefly (more than 50 percent) of calcium carbonate, primarily in the form of calcite.

LITHIC: A stone or rock exhibiting modification by humans. It generally applies to projectile points, scrapers and chips, rather than ground stone.

LITHIC SCATTER: A prehistoric cultural site type where flakes, cores, and stone tools are located as a result of the manufacture or use of the tools.

LOAM: Soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand.

LOCATABLE MINERALS: A mineral subject to location under the 1872 mining laws. Examples of such minerals would be gold, silver, copper, and lead as compared to oil and natural gas, which are leasable minerals.

LONG-TERM PLANNING: Twenty years and beyond; approximately the year 2012.

METALLIC MINERALS: Those minerals whose native form is metallic or whose principal products after refinement are metallic.

MIC ALLOTMENT CATEGORY CRITERIA:

Maintain Category Criteria

a. Present range condition is satisfactory.
b. Allotments have moderate or high resource production potential, and are producing near their potential.
c. No serious resource-use conflicts or controversies exist.
d. Opportunities may exist for positive economic return from public investments.
e. Present management appears to be satisfactory.
f. Other criteria appropriate to Environmental Impact Statement area.

Improve Category Criteria

a. Present range condition is unsatisfactory.
b. Allotments have moderate to high resource production potential and are producing at low to moderate levels.
c. Serious resource-use conflicts and controversies exits.
d. Opportunities exist for positive economic return from public investments.
e. Present management appears unsatisfactory.
f. Other criteria appropriate to Environmental Impact Statement area.

Custodial Category Criteria

a. Present range condition is not a factor.
b. Allotments have low resource production potential, and are producing near their own potential.
c. Limited resource-use conflicts and controversies exist.
d. Opportunities for positive economic return on public investment do not exist or are constrained by technological or economic factors.
e. Present management appears satisfactory or is the only logical practice under existing resource conditions.
f. Other criteria appropriate to Environmental Impact Statement area.

MID SERAL STAGE: A plant community with a species composition which is 26-50% of the potential natural community one would expect to find on that ecological site.

MINERAL ENTRY: The location of mining claims by an individual to protect his right to a valuable mineral.

MINERAL WITHDRAWALS: Closure of land to mining laws, including sales, leasing and location, subject to valid existing rights.

MITIGATION: The lessening of a potential adverse effect by applying appropriate protection measures, the recovery of cultural resource data or other measures.

MODERATE USE: Indicates that 40-60 percent of current year's forage production has been eaten or destroyed by grazing animals.

MONITORING: The orderly collection and analysis of data to evaluate progress in meeting resource management objectives.

MULTIPLE USE: Management of public lands and their various resource values so that they are used in the combination best meeting the present and future needs of the American people. Relative resource values are considered, not necessarily the combination of uses that will give the greatest potential economic return or the greatest unit output.

NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS): National standards, established under the Clean Air Act by the Environmental Protection Agency (EPA), prescribed levels of pollution in the outdoor air which may not be exceeded. There are two levels of NAAQS: primary, set at a level to protect the public health from air pollution damage, and secondary set at a level to protect public welfare from air pollution damage.

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA) OF 1969: A law enacted on January 1, 1970 that established a national policy to maintain conditions under which man and nature can exist in productive harmony and fulfill the social, economic, and other requirements of present and future generations of Americans. It established the Council on Environmental Quality for coordinating environmental matters at the federal level and to serve as advisor to the President on such matters. The law made all federal actions and proposals which could have significant impact on the environment subject to review by federal, state, and local environmental authorities.

NATIONAL HISTORIC PRESERVATION ACT (NHPA): The primary federal law providing for the protection and preservation of cultural resources. NHPA established the National Register of Historic Places, the Advisory Council on Historic Preservation, and the State Historic Preservation Officers.

NATIONAL REGISTER OF HISTORIC PLACES (NRHP): A list of districts, sites, buildings, structures, and objects significant in American history, architecture, archeology, and culture maintained by the Secretary of the Interior. Expanded as authorized by Section 2(b) of the Historic Sites Act of 1935 (16 U.S.C. 462) and Section 101(a) (1)(A) of the National Historic Preservation Act.

NATURAL AREA: Land managed for (1) retention of its typical or unusual plant or animal types, associations or other biotic phenomena; or (2) its outstanding scenic, geologic, soil or aquatic features or processes.

NONPOINT POLLUTION: Pollution from scattered sources, as opposed to pollution from one location, e.g. a manufacturing plant.

NONUSE: Current authorized grazing use (in AUMs) that is not used during a given time period. Nonuse is applied for and authorized on an annual basis.

OFF-ROAD VEHICLE (ORV): Any motorized vehicle capable of or designed for cross-country travel over any type of natural terrain.(43 CFR 8340.0-5(a)). Often use interchangeably with OHV.

OFF-HIGHWAY VEHICLE: Any motorized vehicle or mechanical transport designed for moving people or materials in or over land, water, snow or air that has moving parts and that is powered by a living or nonliving power source. This does not include wheelchairs when used as necessary medical appliances. This term is used interchangeably with ORV which more specifically refers to motorized vehicles as defined in 43 CFR 8340.

OFF-HIGHWAY VEHICLE DESIGNATIONS: BLM designations used in this document are as follows:

Open areas are designated areas and trails where ORVs may operate without restrictions.

Limited areas are designated areas and trails where the use of ORVs is subject to restrictions such as limits on the number or types of vehicles allowed or the dates and times of use, limit of use to existing roads and trails, or limit of use to designated roads and trails.

Closed areas are areas and trails where the use of ORVs are permanently or temporarily prohibited. Emergency use of vehicles is allowed.

OVERGRAZING: Consumption of vegetation by herbivores beyond the endurance of a plant to survive.

PERENNIAL PLANT SPECIES: A plant that has a life cycle of 3 years or more.

PERENNIAL STREAM: A stream of portion of stream which flows continually.

PERMITTEE: One who holds a permit to graze livestock on public land.

PETROGLYPH: A form of rock art manufactured by incising, scratching or pecking designs into rock surfaces.

PICTOGRAPH: A form of rock art created by applying mineral based or organic paints to rock surfaces.

PLANT COMMUNITY: One or more plant species growing in association on a given location of area.

PLAYA: The usually dry and nearly level lake plain that occupies the lowest part of a closed depression.

POTENTIAL NATURAL COMMUNITY: The stable biotic community that would become established on an ecological site if all successional stages were completed without human interference under present environmental conditions.

PREDATOR: An animal that preys on one or more other animals.

PRIMITIVE: One of the six classes of the recreation opportunity spectrum. Primitive areas offer recreation opportunities for isolation from the sights and sounds of human activities, where a visitor can feel a part of the natural environment, experience a high degree of challenge and risk, and use outdoor skills.

PROPER FUNCTIONING CONDITION: Riparian-wetland areas are functioning properly when adequate vegetation, landform, or large woody debris is present to dissipate stream energy associated with high waterflows, thereby reducing erosion and improving water quality; filter sediment capture bedload, and aid floodplain development; improve against cutting action; develop diverse ponding and channel characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses; and support greater biodiversity. The functioning condition of riparian-wetland areas is a result of interaction among geology, soil, water, and vegetation.

PROPOSED SPECIES: Any species of plant or animal formally proposed by the U.S. Fish and Wildlife Service to be listed as threatened or endangered under the Endangered Species Act.

PUBLIC LAND: Any land and interest in land owned by the United States and administered by the Secretary of the Interior through the Bureau of Land Management, without regard to how the United States acquired ownership, except lands located on the Outer Continental Shelf; lands held for the benefit of Indians, Aleuts, and Eskimos; and lands in which the United States retains the minerals, but surface is private.

RANGE IMPROVEMENT: A structure, development or treatment used to rehabilitate, protect or improve the public lands to advance range betterment.

RANGE SITE: Rangeland that differs in its ability to produce a characteristic natural plant community. A range site is the product of all the environmental factors responsible for its development. It is capable of supporting a native plant community typified by an association of species that differ from other range sites in the kind or proportion of species or in total production.

RANGE TREND: The direction of change in range condition; it indicates whether range condition is improving, declining or remaining stable.

RANGELAND CONDITION (ECOLOGICAL): The present state of the vegetation on a range site in relation to the climax (natural potential) plant community for that site. It is an expression of the relative degree to which the kinds, proportions, and amounts of plants in a plant community resemble that of the climax plant community for the site. Rangeland condition is basically an ecological rating of the plant community.

There are four classes that are used to express the degree to which the composition of the present plant community reflects that of the climax.

Condition Class	**Range Site**
PNC	76-100
Late	51-75
Mid	26-50
Early	0-25

RANGELAND CONDITION TREND: The direction of change in rangeland condition.

RAPTOR: Any predatory bird (such as a falcon, hawk, eagle or owl) that has feet with sharp talons or claws
adapted for seizing prey and a hooked beak for shearing flesh.

RIPARIAN/WETLAND AREA: A riparian/wetland area is an area of land directly influenced by permanent water. It has visible vegetation or physical characteristics reflective of permanent water influence. Lakeshores and streambanks are typical riparian areas. Excluded are such sites as ephemeral streams or washes that do not exhibit the presence of vegetation dependent upon free water in the soil.

RIPARIAN ZONE: The banks and adjacent areas of water bodies, water courses, seeps, springs, and meadows, whose waters provide soil moisture sufficiently in excess of that otherwise available locally so as to provide a more moist habitat than that of contiguous plains and uplands.

ROCK ART (PETROGLYPH OR PICTOGRAPH):. An Archaic to Modern cultural site type consisting of incised or painted figures such as people, animals, plants or abstracts on a rock surface.

ROCK SHELTER: An archaeological or cultural resource site type consisting of an area protected by an overhanging cliff. Rock shelters were used by aboriginal Native Americans from the earliest known presence in the region until the early 1920s. The sites are often associated with the same materials as a campsite or rock art.

RUNOFF: A general term used to describe the portion of precipitation on the land that ultimately reaches streams; may include channel and non-channel flow.

RURAL: One of the six classes of the recreation opportunity spectrum. In rural areas, opportunities to experience recreation in affiliation with individuals and groups are prevalent, as is the convenience of recreation sites. These factors generally are more important than the natural setting. Opportunities for wildland challenges, risk taking, and testing of outdoor skills are unimportant except in activities involving challenge and risk.

SAND: Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and less that 10 percent clay.

SECTION: One square mile or 640 acres.

SECTION 202 WILDERNESS STUDY AREA: A Wilderness Study Area under study through the authority of Section 202 of the *Federal Land Policy and Management Act* of 1976. This requires recurrent land use planning by the Bureau of Land Management.

SEDIMENT: Solid, clastic material, both mineral and organic, that is in suspension, is being transported or has been moved from its site of origin by water, wind, or ice and has come to rest on the earth's surface.

SENSITIVE SPECIES: Species of plant and animal designated as such by the BLM State Director, in cooperation with the State of Nevada Department of Conservation and Natural Resources. BLM policy is to provide these species with the same level of protection as is provided for candidate species under BLM Manual 6840.06D.

SEVERE USE: Utilization in excess of 80 percent.

SHORT-TERM IMPACT: Ten years or less; approximately the year 2011.

SILT: Sedimentary material consisting primarily of mineral particles intermediate in size between sand and clay/

SLIGHT USE: Indicates that 0 to 20 percent of current year's forage production has been eaten or destroyed by grazing animals.

SOILS: (a) The unconsolidated mineral material on the immediate surface of the earth that serves as a natural medium for the growth of land plants. (b) The unconsolidated mineral matter of the surface of the earth that has been influenced by genetic and environmental factors including parent material, climate, topography, all acting over a period of time and producing soil that differs from

the parent material in physical, chemical, biological, and morphological properties and characteristics.

SOIL ASSOCIATIONS: (a) A group of defined and named taxonomic soil units occurring together in an individual and characteristic pattern over a geographic region, comparable to plant associations in many ways. (b) A soil mapping unit in which two or more defined taxonomic units occurring together in a characteristic pattern are combined because of map scale or intermixing of taxonomic units.

SOIL COMPACTION: A decrease in the volume of a soil as a result of compressive stress from livestock trampling as an example.

SOIL DEPTH:

Lower boundary in inches.	
Very shallow	12
Shallow	12 – 20
Moderately deep	20 – 36
Deep	36 – 40
Very deep	40

SOIL PROFILE: A succession of soil zones or horizons beginning at the surface that have been developed through normal soil-forming processes.

SOIL SERIES: A group of soils having genetic horizons (layers) that, except for texture of the surface layer, have similar characteristics and arrangement in the profile.

SPECIAL STATUS SPECIES: Special status species include all species of plants and animals that are federally listed as threatened, endangered or candidates for listing; species proposed for listing as threatened or endangered; species listed by the State for reasons of endangerment or extinction; and species identified by the BLM as sensitive.

SUCCESSION: An orderly process of community development that involves changes in species structure and community processes with time; it is reasonably directional and, therefore, predictable.

SUSTAINED YIELD: The achievement and maintenance in perpetuity of a high level of annual or regular periodic output of the various renewable resources of the public lands consistent with multiple use.

THREATENED SPECIES: Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range, and as further defined by the Endangered Species Act of 1973.

THRIVING NATURAL ECOLOGICAL BALLANCE: A thriving ecological balance occurs when: 1) use of key perennial forage species within Herd Management Areas does not exceed 50 percent for grasses and 45 percent of current year's growth for shrubs and forbs; 2) forage plant species exhibit static or apparent upward trend; 3) sufficient water is available for the number of animals found in the Herd Management Area; and 4) the wild horses and burros found in an area are in fair to good physical condition throughout the year.

TRADITIONAL CULTURAL PROPERTY: A specific location where a community traditionally conducted exclusive or special activities, or has a unique significance in its spiritual or religious world. Its principal values are often intangible, and not restricted to locations of archaeological artifacts or locations. A Traditional Cultural Property may be encompassed by a Traditional Lifeway Area.

UTILIZATION: The portion of the current year's forage production that is consumed or destroyed by grazing animals.

VEGETATION STATUS: The expression of the relative degree to which the kinds, proportions, and amounts of plants in a community resemble that of the potential plant community (see early seral, mid seral, late seral and potential natural community).

VIABLE POPULATION: A population that contains an adequate number of individuals appropriately distributed to ensure a high probability of long-term survival without significant human intervention.

VIEWSHED: The landscape that can be directly seen under favorable atmospheric conditions from a viewpoint or along a transportation corridor.

VISUAL RESOURCES: Visible features of the landscape including land, water, vegetation, and animals.

VISUAL RESOURCE MANAGEMENT (VRM): The planning, designing, and implementation of management objectives for maintaining scenic value and visual quality on public lands (see appendix on BLM Visual Resource Management).

WASH (DRY WASH): The channel of a flat-floored ephemeral stream, commonly with very steep to vertical banks cut in unconsolidated material. It is usually dry but can be transformed into a temporary watercourse or short-lived torrent after heavy rain within the watershed.

In southern Nevada, dry washes are commonly used transportation corridors due to flat sand or gravel surfaces, lack of vegetation and accessibility as compared to the surrounding terrain. Casual off-road vehicle use would be limited to those dry washes greater than 8 feet in width.

WILDERNESS CHARACTERISTICS: Identified by Congress in the 1964 Wilderness Act; namely size, naturalness, outstanding opportunities for solitude or a primitive and unconfined type of recreation, and supplemental values such as geological, archeological, historical, ecological, scenic, or other features. It is required that the area possess at least 5,000 acres or more of contiguous public land or be of a size to make practical its preservation and use in an unimpaired condition; be substantially natural or generally appear to have been primarily by the forces of nature, with the imprint of man being substantially unnoticeable; and have either outstanding opportunities for solitude or a primitive and unconfined type of recreation.

WILDERNESS STUDY AREAS (WSA): A roadless area which has been found to have wilderness characteristics.

WILDERNESS STUDY CRITERIA: The criteria and quality standards developed in the Wilderness Study Policy to guide planning efforts in the wilderness EISs.

WILD HORSE AREA: An area of the public lands which provides habitat for one or more wild horse herds.

WILD HORSE: All unbranded and unclaimed horses and their progeny that have used public lands on or after December 15, 1971, or that do use these lands as all or part of their habitat.

THIS PAGE DELIBERATELY LEFT BLANK

INDEX

INDEX

*U.S. GPO 2001-0-683-036/30007