Nellis AFB, Nevada 89191

NELLIS AIR FORCE BASE
PLAN 126-4

INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN

May 2007

DRAFT
INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
NELLIS AIR FORCE BASE/NEVADA TEST AND TRAINING RANGE

Nellis Air Force Base, Nevada
99th Civil Engineering Squadron
Environmental Management Flight

In accordance with Public Law 105-85, the Sikes Act Improvement Act of 1997,
This Plan was prepared in coordination with the
U.S. Fish and Wildlife Service and
Nevada Division of Wildlife

May 2007

THIS PAGE IS INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

Page No.

List of Acronyms xiv
COMMANDER'S SUMMARY CS-1

1.0 GENERAL INFORMATION 1-1
1.1 The Military Mission 1-1
1.1.1 Military Operations and Training 1-2
1.1.2 Public Safety 1-4
1.1.3 Summary 1-4
1.2 The Integrated Natural Resource Management Plan 1-5
1.2.1 Purpose 1-6
1.2.2 Goals 1-7
1.2.3 Objectives 1-8
1.2.4 Monitoring and Evaluating Attainment of Goals 1-9
1.2.5 Management Guidelines 1-10
1.2.6 Authority 1-10
1.2.7 Management Philosophy 1-13
1.2.8 Conditions for Implementation and Revision 1-14
1.2.8.1 Addressing Natural Resource Concerns During Planning .. 1-14
1.2.8.2 Approvals and Revisions 1-15
1.2.9 Responsibilities 1-15
1.2.9.1 Responsibilities of BLM 1-16
1.2.9.2 Responsibilities of the USFWS 1-17
1.2.9.3 Responsibilities of NDOW 1-17
1.2.10 Environmental Documentation 1-22
1.2.11 Exempted Resources 1-22
1.2.12 References 1-22

2.0 INSTALLATION OVERVIEW 2-1
2.1 Location and Area 2-1
2.1.1 NAFB 2-2
2.1.2 NTTR 2-3
2.2 Installation History 2-5
2.2.1 NAFB 2-5
2.2.2 NTTR 2-5
2.3 Land Classification within NTTR and NAFB 2-6
2.4 Military Mission 2-8
2.4.1 Natural Resources Required to Support the Military Mission 2-10
2.4.2 Effects of the Military Mission on Natural Resources 2-10

2.4.2.1 Noise 2-10
2.4.2.2 Fire 2-11
2.4.2.3 Hazardous and Toxic Materials 2-11
2.4.2.4 Geology and Soils 2-11
2.4.2.5 Water Resources 2-11
2.4.2.6 Vegetation 2-12
2.4.2.7 Wildlife 2-12
2.4.3 Potential Impacts of the Military Mission on Natural Resources in the Future 2-14
2.4.3.1 Installation Restoration Program (IRP) Sites 2-14
2.4.3.2 Ordnance 2-15
2.4.3.3 Noise 2-15
2.4.3.4 Hazardous Wastes 2-16
2.4.3.5 Infrastructure 2-16
2.4.4 Natural Resource Constraints to the Mission and Mission Planning 2-16
2.5 Surrounding Communities 2-17
2.6 Local Prominent Areas 2-18
2.7 References 2-19

3.0 NATURAL RESOURCE DATABASE 3-1
3.1 Current Status of GIS 3-1
3.1.1 NAFB 3-1
3.1.2 NTTR 98th Range Wing 3-3
3.2 Needs Assessment and Recommendations for GIS 3-3
3.2.1 Infrastructure 3-3
3.2.2 Natural Resources 3-4
3.3 Training Programs for GIS 3-12
3.4 References 3-12

4.0 NATURAL RESOURCES AND THEIR MANAGEMENT 4-1
4.1 Climate and General Ecological Setting 4-1
4.1.1 NAFB 4-1
4.1.2 NTTR 4-1
4.1.3 References 4-5
4.2 Topography 4-6
4.2.1 Description of Current Conditions 4-6
4.2.2 Needs Assessment 4-9
4.2.3 Management Goals within the Mission 4-10
4.2.4 Management Guidelines 4-10
4.2.5 Projects 4-11
4.2.6 References 4-11

4.3 Geology 4-12
4.3.1 Description of Current Conditions 4-12
4.3.2 Needs Assessment 4-13
4.3.3 Management Goals within the Mission 4-15
4.3.4 Management Guidelines 4-15
4.3.5 Projects 4-16
4.3.6 References 4-16
4.4 Mineral Resources 4-19
4.4.1 Description of Current Conditions 4-19
4.4.2 Needs Assessment 4-19
4.4.3 Management Goals within the Mission 4-20
4.4.4 Management Guidelines 4-20
4.4.5 Projects 4-21
4.4.6 References 4-21
4.5 Soils 4-22
4.5.1 Description of Current Conditions 4-22
4.5.2 Needs Assessment 4-26
4.5.3 Management Goals within the Mission 4-27
4.5.4 Management Guidelines 4-27
4.5.5 Projects 4-28
4.5.6 References 4-29
4.6 Water Resources 4-30
4.6.1 Surface Waters 4-30
4.6.1.1 Description of Current Conditions 4-30
4.6.1.2 Needs Assessment 4-34
4.6.1.3 Management Goals within the Mission 4-35
4.6.1.4 Management Guidelines 4-36
4.6.1.5 Projects 4-37
4.6.1.6 References 4-37
4.6.2 Groundwater 4-38
4.6.2.1 Description of Current Conditions 4-38
4.6.2.2 Needs Assessment 4-39
4.6.2.3 Management Goals within the Mission 4-39
4.6.2.4 Management Guidelines 4-40
4.6.2.5 Projects 4-40
4.6.2.6 References 4-40
4.6.3 Wetlands 4-41
4.6.3.1 Description of Current Conditions 4-41
4.6.3.2 Needs Assessment 4-43
4.6.3.3 Management Goals within the Mission 4-44
4.6.3.4 Management Guidelines 4-44
4.6.3.5 Projects 4-45

4.6.3.6 References 4-45
4.6.4 Floodplains 4-46
4.6.4.1 Description of Current Conditions 4-46
4.6.4.2 Needs Assessment 4-48
4.6.4.3 Management Goals within the Mission 4-48
4.6.4.4 Management Guidelines 4-48
4.6.4.5 Projects 4-49
4.6.4.6 References 4-49
4.7 Flora 4-50
4.7.1 Native Vegetation 4-50
4.7.1.1 Description of Current Conditions 4-50
4.7.1.2 Needs Assessment 4-57
4.7.1.3 Management Goals within the Mission 4-59
4.7.1.4 Management Guidelines 4-60
4.7.1.5 Projects 4-61
4.7.1.6 References 4-61
4.7.2 Turf and Landscape 4-64
4.7.2.1 Description of Current Conditions 4-64
4.7.2.2 Needs Assessment 4-65
4.7.2.3 Management Goals within the Mission 4-65
4.7.2.4 Management Guidelines 4-66
4.7.2.5 Projects 4-66
4.8 Fauna 4-66
4.8.1 Non-Game Species 4-68
4.8.1.1 Bats 4-68
4.8.1.1.1 Description of Current Conditions 4-68
4.8.1.1.2 Needs Assessment 4-68
4.8.1.1.3 Management Goals within the Mission 4-69
4.8.1.1.4 Management Guidelines 4-69
4.8.1.1.5 Projects 4-70
4.8.1.1.6 References 4-70
4.8.1.2 Migratory Birds and Raptors 4-71
4.8.1.2.1 Description of Current Conditions 4-71
4.8.1.2.2 Needs Assessment 4-72
4.8.1.2.3 Management Goals within the Mission 4-73
4.8.1.2.4 Management Guidelines 4-73
4.8.1.2.5 Projects 4-74
4.8.1.2.6 References 4-74
4.8.1.3 Reptiles and Amphibians 4-75
4.8.1.3.1 Description of Current Conditions 4-75
4.8.1.3.2 Needs Assessment 4-76
4.8.1.3.3 Management Goals within the Mission 4-76

4.8.1.3.4 Management Guidelines 4-76
4.8.1.3.5 Projects 4-77
4.8.1.3.6 References 4-77
4.8.1.4 Small Mammals 4-78
4.8.1.4.1 Description of Current Conditions 4-78
4.8.1.4.2 Needs Assessment 4-78
4.8.1.4.3 Management Goals within the Mission 4-78
4.8.1.4.4 Management Guidelines 4-79
4.8.1.4.5 Projects 4-79
4.8.1.4.6 References 4-79
4.8.1.5 Wild Horses 4-80
4.8.1.5.1 Description of Current Conditions 4-80
4.8.1.5.2 Needs Assessment 4-81
4.8.1.5.3 Management Goals within the Mission 4-82
4.8.1.5.4 Management Guidelines 4-82
4.8.1.5.5 Projects 4-83
4.8.1.5.6 References 4-83
4.8.2 Large Mammals 4-84
4.8.2.1 Description of Current Conditions 4-84
4.8.2.2 Needs Assessment 4-86
4.8.2.3 Management Goals within the Mission 4-86
4.8.2.4 Management Guidelines 4-86
4.8.2.5 Projects 4-87
4.8.2.6 References 4-88
4.9 Threatened and Endangered Species 4-89
4.9.1 Desert Tortoise 4-93
4.9.1.1 Description of Current Conditions 4-93
4.9.1.2 Needs Assessment 4-96
4.9.1.3 Management Goals within the Mission 4-97
4.9.1.4 Management Guidelines 4-97
4.9.1.5 Projects 4-98
4.9.1.6 References 4-99
4.9.2 Sensitive Species 4-101
4.9.2.1 Las Vegas Bearpoppy 4-102
4.9.2.1.1 Description of Current Conditions 4-102
4.9.2.1.2 Needs Assessment 4-103
4.9.2.1.3 Management Goals within the Mission 4-103
4.9.2.1.4 Management Guidelines 4-104
4.9.2.1.5 Projects 4-104
4.9.2.1.6 References 4-105
4.9.2.2 Rare Plants 4-106
4.9.2.2.1 Description of Current Conditions 4-106

4.9.2.2.2 Needs Assessment 4-109
4.9.2.2.3 Management Goals within the Mission 4-109
4.9.2.2.4 Management Guidelines 4-109
4.9.2.2.5 Projects 4-110
4.9.2.2.6 References 4-110
4.9.2.3 Sage Grouse 4-111
4.9.2.3.1 Description of Current Conditions 4-111
4.9.2.3.2 Needs Assessment 4-112
4.9.2.3.3 Management Goals within the Mission 4-112
4.9.2.3.4 Management Guidelines 4-113
4.9.2.3.5 Projects 4-113
4.9.2.4 Pygmy Rabbit 4-114
4.9.2.4.1 Description of Current Conditions 4-114
4.9.2.4.2 Needs Assessment 4-115
4.9.2.4.3 Management Goals within the Mission 4-115
4.9.2.4.4 Management Guidelines 4-115
4.9.2.4.5 Projects 4-115
4.9.2.4.6 References 4-116
4.9.2.5 Burrowing Owl 4-116
4.9.2.5.1 Description of Current Conditions 4-116
4.9.2.5.2 Needs Assessment 4-117
4.9.2.5.3 Management Goals within the Mission 4-117
4.9.2.5.4 Management Guidelines 4-118
4.9.2.5.5 Projects 4-118
4.9.2.5.6 References 4-119
4.9.2.6 Chuckwalla 4-120
4.9.2.6.1 Description of Current Conditions 4-120
4.9.2.6.2 Needs Assessment 4-120
4.9.2.6.3 Management Goals within the Mission 4-120
4.9.2.6.4 Management Guidelines 4-121
4.9.2.6.5 Projects 4-121
4.9.2.6.6 References 4-121
4.9.2.7 Banded Gila monster 4-122
4.9.2.7.1 Description of Current Conditions 4-122
4.9.2.7.2 Needs Assessment 4-122
4.9.2.7.3 Management Goals within the Mission 4-122
4.9.2.7.4 Management Guidelines 4-122
4.9.2.7.5 Projects 4-123
4.9.2.7.6 References 4-123
4.9.2.8 Phainopepla 4-124
4.9.2.8.1 Description of Current Conditions 4-124
4.9.2.8.2 Needs Assessment 4-124

4.9.2.8.3 Management Goals within the Mission 4-124
4.9.2.8.4 Management Guidelines 4-124
4.9.2.8.5 Projects 4-125
4.9.2.8.6 References 4-125
4.10 Fire Management 4-126
4.10.1 Description of Current Conditions 4-126
4.10.2 Needs Assessment 4-126
4.10.3 Management Goals within the Mission 4-126
4.10.4 Management Guidelines 4-127
4.10.5 Projects 4-127
4.10.6 References 4-127
4.11 Pest Management 4-128
4.12 Invasive Species 4-128
4.12.1 Description of Current Conditions 4-128
4.12.2 Needs Assessment 4-129
4.12.3 Management Goals within the Mission 4-129
4.12.4 Management Guidelines 4-129
4.12.5 Projects 4-130
4.12.6 References 4-130
4.13 Domestic Animals 4-130
4.14 Cultural Resources 4-130
4.15 Hazardous Waste Management 4-131

5.0 OVERALL MANAGEMENT PLAN 5-1
5.1 Sensitivity Map 5-1
5.2 Land Use Recommendation Model 5-1
5.3 Pilot Study 5-1
5.4 Updating the Database 5-1
5.5 Needs Assessment 5-2

6.0 PROGRAMS 6-1
6.1 Outdoor Recreation 6-1
6.1.1 Objectives 6-1
6.1.2 Military Mission Considerations 6-1
6.1.3 Public Access 6-1
6.1.4 Hunting Programs 6-2
6.1.5 Other Natural Resources Oriented Recreation 6-2
6.2 Safety and Security 6-2
6.3 Education and Interpretive Programs 6-3
6.3.1 Objectives 6-3
6.3.2 Military Personnel/Contractor Awareness Training 6-3
6.3.3 Public Awareness 6-4

6.4 References 6-4

7.0 IMPLEMENTATION 7-1
7.1 Work Plans 7-1
7.2 Natural Resources Management Staffing 7-11
7.3 Annual Coordination Requirements 7-12
7.4 Monitoring INRMP Implementation 7-13

LIST OF TABLES

Table 1-1 Natural Resource Management Authority Documents and Topics 1-11

Table 1-2 Organizations and Roles in Natural Resources Management, Nellis Air Force Base and NTTR 1-19

Table 2-1 Named and Numbered Ranges of NTTR 2-4

Table 2-2 Land Classifications (in acres) of Nellis Air Force Base and NTTR 2-7

Table 2-3 USAFWC Military Units and Missions at NAFB and NTTR 2-8

Table 2-4 Military Activities on NTTR that Could Potentially Impact Natural Resources 2-13

Table 3-1 Currently Available GIS Data at NAFB and NTTR 3-6

Table 3-2 Data Gaps Identified for the INRMP 3-8

Table 4-1 Temperature and Precipitation Data Recorded at Las Vegas McCarran International Airport, Nevada, 1937-2005 4-2

Table 4-2 Temperature and Precipitation Data Recorded at Desert Game Range, Nevada, 1948-2005 4-2

Table 4-3 Temperature and Precipitation Data Recorded at Goldfield, Nevada, 1948-2005 4-3

Table 4-4 State and Federal Listed Reptile and Amphibian Species of Concern Potentially Found on NTTR and NAFB 4-90

Table 4-5 State and Federal Listed Bird Species of Concern Potentially Found on NTTR and NAFB 4-91

Table 4-6 State and Federal Listed Mammal Species of Concern Potentially Found on NTTR and NAFB 4-92

Table 4-7 Plant Species of Concern on NTTR 4-108

Table 7-1 Proposed Projects to Support the INRMP, Project Number, Priority, and Regulatory Drivers 7-1

Table 7-2 Proposed Projects to Support the INRMP Describing the Justification and Impacts to the Mission by the Projects 7-2

Table 7-3 Proposed Projects to Support the INRMP and the Tasks Associated with each Project 7-3

LIST OF FIGURES

Figure 1-1 Organizational chart illustrating the command structure that includes 99thABW and 99thCES/CEV 1-18

Figure 2-1 Location of NTTR and NAFB with respect to the Great Basin and Mojave Desert Ecoregions 2-1

Figure 2-2 NAFB map showing the location of the Small Arms Range and the three management areas 2-2

Figure 2-3 Locations of areas within NTTR managed by different federal agencies 2-3

Figure 2-4 Named and numbered ranges located in NTTR 2-4

Figure 2-5 Parks and natural areas located in the vicinity of NAFB and NTTR 2-19

Figure 4-1 Average annual precipitation in the area surrounding NAFB and NTTR 4-4

Figure 4-2 Average daily low temperature each year across NAFB and NTTR 4-4

Figure 4-3 Average daily high temperature each year across NAFB and NTTR 4-5

Figure 4-4 General topographic map of NTTR and NAFB 4-6

Figure 4-5 Major physiographic features found on NTTR 4-9

Figure 4-6 Faults and seismic zones found on NAFB and NTTR 4-14

Figure 4-7 Soil map units found on NAFB and vicinity as shown in the soil survey 4-24

Figure 4-8 General soil associations found on NAFB and NTTR 4-25

Figure 4-9 Surface waters found on NAFB 4-30

Figure 4-10 Springs and other surface waters found on NTTR 4-32

Figure 4-11 Watersheds or hydrologic units found on NTTR 4-35

Figure 4-12 Floodplains as mapped on NTTR 4-47

Figure 4-13 Plant communities mapped on the South Range of NTTR 4-55

Figure 4-14 Plant communities mapped on the North Range of NTTR 4-58

LIST OF APPENDICES

Appendix A Proposed Desert Tortoise Management Plan

LIST OF ACRONYMS AND ABBREVIATIONS

98th RANW	98thth Range Wing
99th ABW	99thth Air Base Wing
99th ABW/CC	99thth Air Base Wing Commander
99th CES	99thth Civil Engineering Squadron
99th CES/CEVN	99thth Civil Engineering Squadron, Natural and Cultural Resources Section
ACC	Air Combat Command
ACOE	U.S. Army Corps of Engineers
AFB	Air Force Base
AICUZ	Air Installation Compatible Use Zone
USAFWC	U.S. Air Force Warfare Center
BASH	Bird Aircraft Strike Hazard
BLM	Bureau of Land Management, Department of the Interior
BLM RMP	BLM Resource Management Plan
CCRFCD	Clark County Regional Flood Control District
CES	Civil Engineering Squadron
CRP	Comprehensive Range Plan
CWA	Clean Water Act
DNWR	Desert National Wildlife Range
DNWRC	Desert National Wildlife Refuge Complex
DoD	Department of Defense
DoE	Department of Energy
DoI	Department of Interior
DU	Depleted uranium
DWMA	Desert Wildlife Management Area
EA	Environmental Assessment
EIAP	Environmental Impact Analysis Process
EO	Executive Order
EOD	Explosive Ordnance Disposal
ESA	Endangered Species Act
ESOHLC	Environmental Safety and Occupational Health Leadership Council
ESRI	Environmental Systems Research Institute, Inc.
GP	Base General Plan
GIS	Geographic Information System
GPS	Global Positioning System
HQ	Headquarters
HQ A7VP	ACC Environmental Analysis Branch
INRMP	Integrated Natural Resources Management Plan
IRP	Installation Restoration Program
CREECH AFB	Creech Air Force Base, formerly Indian Springs Air Force Auxiliary Field
LAN	Local Area Network
LDG	Landscape Design Guide
LLTR	Leach Lake Tactics Range
MAJCOM	Major Command
MBTA	Migratory Bird Treaty Act of 1918
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NAFB	Nellis Air Force Base

NDOW	Nevada Department of Wildlife
NEPA	National Environmental Policy Act
NNSA	National Nuclear Security Administration
NPS	National Park Service
NRA	National Recreation Area
NRCS	Natural Resources Conservation Service
NTTR	Nevada Test and Training Range
NTTR RMP	NTTR Comprehensive Range Management Plan
NTS	Nevada Test Site
NWHR	Nevada Wild Horse Range
NWR	National Wildlife Refuge
PL	Public Law
PMP	Pest Management Plan
RCRA	Resource Conservation and Recovery Act
RMP	BLM Resource Management Plan
SNWA	Southern Nevada Water Authority
TNC	The Nature Conservancy
UFP	Urban Forest Management Plan
USAF	U.S. Air Force or Air Force
USFS	U.S. Forest Service, Department of Agriculture
USFWS	U.S. Fish and Wildlife Service, Department of the Interior

THIS PAGE IS INTENTIONALLY LEFT BLANK

Nellis Air Force Base/Nevada Test and Training Range
Integrated Natural Resource Management Plan
COMMANDER'S SUMMARY

THE MISSION AND NATURAL RESOURCES

The U.S. Air Force (USAF) is tasked with the primary responsibility for projecting long-range military air power to enhance U.S. defense capability. Realistic training and weapons system testing in an environment similar to real combat conditions are the primary means to ensure readiness and to prepare Air Force personnel and assets to meet and enforce national policies. Realistic training is critical to maintaining military proficiency and ensuring success on the battlefield. The topography and natural resources found at Nellis Air Force Base (NAFB) and the Nevada Test and Training Range (NTTR) closely mimic many of the present-day battlefield environments encountered by the USAF in foreign lands. Proper management of the natural resources at NTTR and NAFB guarantees that those areas will continue to provide the USAF with the sustainable environment required to meet mission goals while maintaining and conserving the integrity of the natural environment.

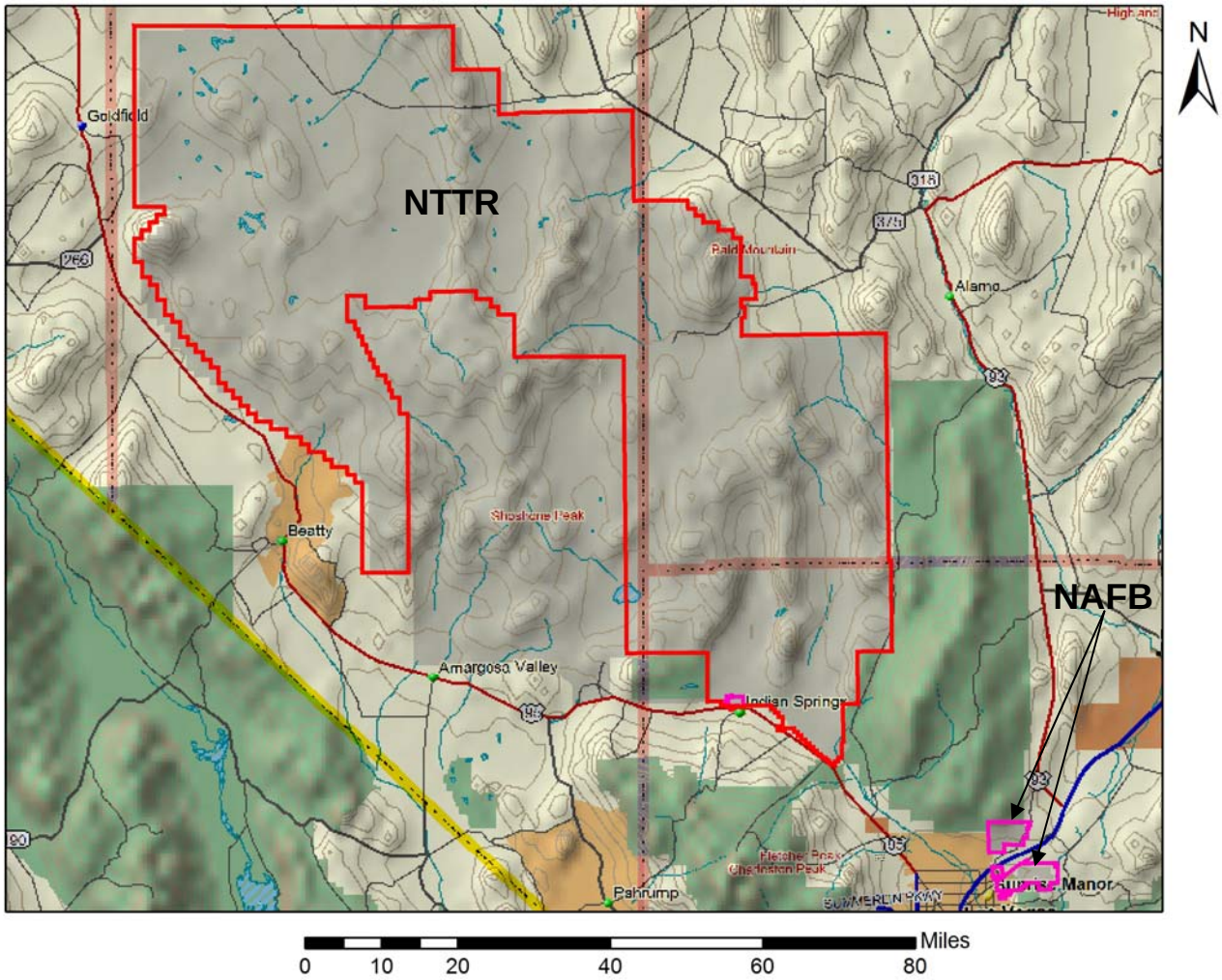
Typical creosote bush habitat around NAFB.

The military and training operations conducted at NAFB in Nevada play a crucial role in the USAF's national defense efforts. The NAFB-based 99th Air Base Wing (99 ABW) assists the Air Combat Command (ACC) in arranging, training, and equipping tactical air forces of the United States and allied nations, primarily by providing advanced tactical training to fighter pilots. The Air Warfare Center (AWFC) is an intermediate headquarters for four wings and 24 detachments at NAFB.

NTTR located adjacent to NAFB is a unique national asset both on a military and environmental basis. The range provides the opportunity for weapons system testing combined with the highest level of training available for military personnel. NTTR provides an aerial battlespace that includes a robust threat environment, varied target arrays, operational airspace, topographic complexity, security, and public safety buffers. The NTTR is the only location in the United States where both individual and large multi-force training can be conducted in a natural environment that simulates full-scale battlefield scenarios. The advanced level of training and testing that NTTR offers is crucial to the survival of U.S. and allied

military personnel and the success of the USAF mission to defend the United States and to secure and enhance U.S. interests and policies around the world.

incorporates natural resource management policies, available regulatory guidance documents, and current natural resource data for NAFB and NTTR to produce a practical



Location of NTTR and NAFB in southern Nevada.

THE INTEGRATED NATURAL RESOURCE MANAGEMENT PLAN

At the direction of the ACC, the 99th Civil Engineering Squadron, Natural and Cultural Resources Flight (99 CES/CEVN) has prepared an Integrated Natural Resource Management Plan (INRMP) to serve as a practical management guideline for the day-to-day operations and management of the natural resources on NAFB and NTTR. The INRMP

guidance document that recognizes and respects the goals and objectives of the Nellis mission while conserving and sustaining the natural resources of both areas. To meet that end, the INRMP provides simple natural resource management guidance to assist the user in making day-to-day decisions that allow for protection and/or conservation of natural resources. The military mission takes precedence over all guidance provided by the INRMP but, whenever possible and feasible, the military mission is executed within the

constraints of existing laws and in a manner that sustains the ranges for future missions..

Tolicha Peak on NTTR.

The INRMP was prepared by 99 CES/CEVN, but involved contributions from other sources. A great deal of time and effort was provided by various groups within NAFB and NTTR with a substantial contribution by 98th Range Wing. Other important contributors to the INRMP outside of the USAF included the U.S. Fish and Wildlife Service, the Nevada Department of Wildlife, and the Bureau of Land Management.

GOALS OF THE INRMP

A primary goal of the INRMP is to maintain ecosystem integrity and dynamics on NAFB and NTTR without compromising the military mission. Maintaining ecosystem integrity promotes good stewardship by protecting existing biodiversity, ensuring lasting use of the installation, and minimizing management costs and efforts. Ecosystem management on NAFB and NTTR is a goal-driven program that supports present and future military mission requirements while managing natural and cultural resources and preserving ecosystem integrity.

General natural resources management goals for NAFB and NTTR include:

- Assist the installation commander with the conservation and rehabilitation of natural resources consistent with the use of the installation to ensure the readiness of the Armed Forces.
- Develop natural resources management guidelines that are consistent with the military mission and ensure no net loss in the capability of installation lands to support the military mission.
- Provide for the optimum use of land and water areas and access for military purposes while maintaining ecological integrity.

In summary, the primary goal of NTTR and NAFB is to support the military mission. The primary goal of the INRMP is to offer guidelines for the proper management and protection of natural resources on NTTR and NAFB in a manner that supports the military mission.

REGULATORY AUTHORITY

The INRMP is prepared under authority of AFI 32-7064 *(Integrated Natural Resources Management)* as implemented by Air Force Policy Directive 32-70 *(Environmental Quality)* and DoD Installation 4715.3 *(Environmental Conservation Program)*. The authority to establish natural resources management programs at DoD installations is provided by 16 USC 670 or Sikes Act (*Conservation Programs on Military Installations*). Additional governing laws include the Endangered Species Act, Clean Water Act, the Migratory Bird Treaty Act, and the Military Land Withdrawal Act.

Pahute Mesa in May.

NATURAL RESOURCES AND THE MISSION

The military mission at NAFB and NTTR requires large expanses of land that are remote and are not developed or inhabited by non-military personnel. Much of the area is used for target and warfare maneuvers practice. A large buffer between the public and target or practice areas is required for security and safety.

At times, the general topographic and vegetative features of the area may also mimic features in other foreign countries where the military may be involved or potentially involved. These areas can be used as the setting for practicing military maneuvers that may be used in those foreign countries. Thus, the most important natural resource used by the military mission is the remoteness and the general physical and biotic character of the area.

Maintaining ecosystem integrity while sustaining the mission environment is of primary importance to 99 CES/CEVN when considering new projects, either internally or for other wings or directorates. Those projects that meet an important mission-related need but do not disrupt natural processes are those that have the highest likelihood of receiving environmental approval.

Cactus Range in November.

Goldfield Hills in October

The INRMP has been developed to support the military mission while facilitating effective ecosystem management for NAFB and NTTR to decrease impacts of military operations on natural resources and develop appropriate natural resource management framework. The INRMP provides the guidance to assist new construction/expansion projects on NAFB and NTTR in avoiding impacts to natural resources during the planning, designing, and management phases where practicable. The INRMP ensures that landscaping at new construction areas and some existing facilities will shift to the use of xeric native species where possible, especially where development interfaces with native habitat. Sensitive habitats, such as desert tortoise, Las Vegas bearpoppy, and Las Vegas buckwheat, are also considered during planning and site selection, and decision-making processes.

NATURAL RESOURCES OF NTTR AND NAFB

It is currently estimated that less than 5% of the land area of NTTR is being impacted by mission activities. This means that 2.7 million acres remained relatively undisturbed by human activity. Human disturbance is minimal due to the fact that most of NTTR is under a high level of security with little or no public access allowed. Thus, many of the plant and animal communities that have become established at NTTR are

attaining ecological succession levels far beyond those occurring outside of the boundaries of the range area. Continued proper management of natural resources at NTTR will ensure that these unique plant and animal communities will be conserved.

In addition to the unique plant communities and topographic features of NTTR, large game species including mule deer, antelope, and desert bighorn are found on NTTR. Of these species, only desert bighorn are hunted on a regular basis through a cooperative agreement with NDOW and the USFWS. Plant and animal species present on NAFB or NTTR are often protected from disturbance or habitat loss because they are designated species with formal legal protection or because they are listed as sensitive species. Sensitive species do not have formal protection, but they have been identified by agencies or conservation organizations as species that are experiencing some level of threat and, therefore, are managed through the INRMP.

Las Vegas Bearpoppy

One plant species and five animal species considered sensitive by resource agencies have been observed, or occur, on NAFB and NTTR. These are the Las Vegas bearpoppy, desert tortoise, chuckwalla, western burrowing owl, banded Gila monster, and phainopepla. The bearpoppy populations are small, but their potential occurrence in the location on undeveloped land should be determined by focused surveys. The chuckwalla, a large lizard, has been confirmed at NAFB by sightings of the species' diagnostic scat. Western burrowing owls have been observed on NAFB and

Desert Tortoise

phainopepla are likely at the Desert Wells Annex because of the suitable habitat found on that property. The Phainopepla is a black bird shaped like a cardinal that is found primarily in mesquite thickets. Several genera of bat species, some of which are sensitive utilize surface water sources. At least 18 species of bats are known within the region. Several rare plant species have been identified and mapped on NTTR by the Nature Conservancy.

CONCLUSION

At the present time, information concerning plant and animal populations at NTTR and NAFB is minimal and the actual functioning of the ecosystem is not well understood. The INRMP recommends plant and animal surveys to establish an information base for further refinement of management guidelines in the future. This information is needed to allow for proper and judicious management of the natural resources currently established at NAFB and NTTR.

It is the intent and purpose of the INRMP to support the military mission while conserving the natural resources found on NTTR and NAFB. The INRMP will assist the military mission with

guidance to ensure mission sustainability on NTTR and NAFB to the highest degree in accordance with the Sikes Act, noting compliance with Sec. 670a(b)(2)(I) “no net loss in the capability of military installation lands, to support military mission of the installation.

1.0 GENERAL INFORMATION

1.1 THE MILITARY MISSION

The U.S. Air Force (USAF or Air Force) is tasked with the primary responsibility for projecting long-range military air power to enhance U.S. defense capability. The USAF is the one branche of the Department of Defense (DoD) with long-range fighters, tankers, electronic warfare and intelligence aircraft, and airlifters, and the only branch with bombers and stealth capabilities, all of which provide the ability to quickly deliver a powerful strike at an enemy over great distances. Air Force missions include space surveillance, tactical battlefield surveillance, aerial transport of troops and material, close air support of land forces, all-weather strike, nuclear deterrence, maritime strike, and air superiority.

The Air Force is committed to maintaining a force that is second to none. The important elements of this force structure include the following:

- Highly trained and motivated aircrews and ground support personnel;
- State-of-the-art tested aircraft, avionics, and weapons;
- An advanced command, control, electronic warfare, surveillance, and intelligence capability;
- Maintenance and logistics (including infrastructure) required by the aircraft, avionics, and weapons systems; and
- The resources and access to airspace and ranges to train aircrews in modern air combat tactics.

Realistic, stressful, and challenging operational training and weapons system testing are the primary means to ensure readiness and prepare the Air Force to apply personnel and assets to meet national policies. Training consists of a careful progression of activities and threat complexity, including a balance of programs directed at individuals, crews, and larger organizational units (including multi-national forces) and performance assessments. Whether training is accomplished as an individual-level mission activity or as a full-scale, multi-force field exercise, realistically evaluated training is critical to maintaining military proficiency. Joint coalition and combined training exercises further improve U.S. military operations and understanding of the strengths of each military service, as well as those of allies and coalition partners.

These interests and policies include ensuring strong relationships with our allies, protecting our rights of trade and travel, and deterring aggression. As a key element of U.S. military power, the USAF has the mission to train for and, when necessary, successfully engage

military forces of hostile nations and organizations. In addition, the Air Force is currently expected to train for and participate in a broad range of conflict prevention, peacekeeping, and humanitarian activities.

The military and training operations conducted at Nellis Air Force Base (NAFB) in Nevada play a crucial role in the USAF's national defense efforts. Known as the "Home of the Fighter Pilot," NAFB provides training for composite strike forces, which includes every type of aircraft offered in the Air Force inventory. The Air Warfare Center (USAFWC) conducts the USAF's most advanced weapons and tactics training for a wide variety of specialties to include Red Flag and the USAF Weapons School. It operates NTTR and the Leach Lake Tactics Range (LLTR). The USAFWC oversees operations for the 53rd, 57th, 98th th, 99th th and 505th Wings. The 98th th RANW provides command and control of the NTTR and the LLTR. The 99th th ABW serves as the host wing for NAFB. It oversees the daily operations of the base such as personnel, finance, civil engineering, and logistics.

The Nevada Test and Training Range (NTTR) located adjacent to NAFB is a unique national asset that provides the opportunity for weapons system testing combined with the highest level of training available for military personnel. The NTTR mission is to provide the highest fidelity battlespace possible in support of DoD testing and training. This battlespace includes a robust simulated threat environment, varied target arrays, operational airspace, topographic complexity, security, and public safety buffers that ensure United States forces remain the best prepared in the world. The NTTR is the only location in the United States where both individual and large multi-force training are provided in highly sophisticated training exercises that simulate full-scale battlefield scenarios. Such training exercises test tactics, equipment, and personnel. The advanced level of training and testing that NTTR offers is crucial to the survival of U.S. and allied military personnel and the success of the USAF mission to defend the United States and to secure and enhance U.S. interests and policies around the world.

The combined missions of NAFB and NTTR are to ensure national security through advanced training and operational testing activities. NAFB also takes extensive measures to ensure public safety. The following sections briefly describe each of these mission requirements.

1.1.1 Military Operations and Training

The purpose of all military activity on NTTR is to enhance U.S. national security. Military operations (including training, testing, and support activities) include all activities and infrastructure necessary to keep U.S. forces prepared for confrontation with any military force the United States might reasonably expect to oppose in the future. Military activities on NTTR support training and testing combat tactics, aircraft, their associated weapons systems, and all the activities that support those primary missions. The supporting infrastructure (all

ground activities, facilities, equipment, personnel, and supporting airspace) must be able to produce a simulated combat environment that can be securely restructured to resemble anticipated threats to U.S. interests.

NAFB supports many military flight training missions. Flight training includes five basic levels: upgrade, re-qualification, continuation, composite force (Red Flag, USAFWS Mission Employment and JEFX exercises); and weapons instruction. Types of advanced training include: air-to-air specific training; tactical air-to-ground weapons delivery training; and conventional weapons delivery training. Although NTTR continues to be used primarily for training, the testing mission makes up an important part of the military use. Testing missions include Tactics Development and Evaluation; Operational Test and Evaluation; Follow-on Test and Evaluation; and Operational Flight Program Development.

The 422nd Test and Evaluation Squadron is dedicated to testing and evaluating various equipment, software, and tactics on F-15C Eagles, F-15E Strike Eagles, F-16 Falcons, F-16C Falcons, A/OA-10 Thunderbolt IIs, F/A-22 Raptors, and HH-60 aircraft. The 66th Rescue Squadron is an operational rescue squadron that flies in the Range to maintain aircrew currency and proficiency. The 11th, 15th, and 17th Reconnaissance Squadron missions provide long endurance, unmanned aerial reconnaissance, surveillance, target acquisition, and target attack, resulting in real-time, multi-sensor imagery and intelligence for the war fighter. NAFB is also the home of the USAF Thunderbirds Air Demonstration Squadron.

The purpose of providing realistic training and testing capability includes simulating combat conditions and characteristics with range infrastructure features. Validating or testing weapons system tactics and training against actual radar systems in a realistic environment can best be accomplished at large area weapons training ranges such as NTTR. Large Flag exercises pit various military forces against an array of defensive air and ground threats. The defensive forces provide realism and enable validation of tactics and weapons systems in a simulated combat environment. The USAF Desert Warfare Training Center provides advanced training to security police personnel from Air Force active duty, National Guard, Reserve units, state and federal law enforcement, and American allies on tactical and weapons

skills for the defense of Air Force bases in a desert environment. Use of the NTTR ensures the capability to apply lessons learned from past military actions in combat and during training and testing activities. Lessons learned in combat environments have produced many valuable insights into training, doctrine, tactics, and force employment.

NAFB also includes electronic combat training. Surface-to-air, defensive threat simulation provides realistic electronic order of battle training. The purpose of electronic combat capability is to exploit the electromagnetic spectrum used by a potential adversary. Electronic combat infrastructure provides sophisticated training and testing capabilities. The purpose of simulated integrated air defense systems (SAIDS) training and testing infrastructure is to provide a reactive and communicating defensive force. Integrated air defenses spread over a large landmass, such as NTTR, provide the capability of simulating theaters of operation.

1.1.2 Public Safety

The Air Force has established a variety of safety standards due to the hazardous nature of the weapons systems. The purpose of USAF safety standards is to protect the public, military personnel, and equipment from accidental damage by weapons systems or practices. One NTTR mission requirement is to provide for public safety as well as national security and military operations. Over the years, safety considerations at NTTR have resulted in rules, regulations, and operational practices that minimize the possibilities of harm to the public.

1.1.3 Summary

The purpose of all military activity at NTTR and NAFB is to provide and improve national defense capability. The aerospace training and testing environment that most closely matches the combat environment of the future will provide the greatest readiness capability. NTTR's large contiguous land areas can be modified to safely simulate the combat environment of potential adversaries which is essential to maintaining and enhancing combat capability and readiness on foreign battlefields. Continuing operation and maintenance of NAFB and NTTR help ensure that current and future military activities continue for that purpose. Specific military units supported at NAFB and NTTR are described later in this document in Section 2.4.

1.2 THE INTEGRATED NATURAL RESOURCE MANAGEMENT PLAN (INRMP)

At the direction of the ACC, the NAFB 99thth Air Base Wing, Base Civil Engineer (99th CES), Environmental Management Flight, Natural and Cultural Resources Section (99th CES/CEVN) has prepared this Integrated Natural Resource Management Plan (INRMP) to serve as a practical management guideline for the natural resources on NAFB and NTTR. The INRMP incorporates natural resource management policies, available regulatory guidance documents, and current natural resource data for NAFB and NTTR to produce a practical guidance document that recognizes and respects the goals and objectives of the Nellis mission while conserving the natural resources of both areas. Natural resources management as implemented by the INRMP is intended to provide and sustain suitable landscapes for military activities without compromising ecosystem health. To meet that end, the INRMP provides the user with past and present natural resource information on NTTR and NAFB through a Geographic Information System (GIS) database, directs the user to additional background information, and recommends guidance to assist the user in making day-to-day decisions that allow for proper ecosystem management.

The INRMP describes management of a living, dynamic system, and therefore will require occasional modification to reflect changes in the system. At the same time, the Nellis mission changes with the needs of national defense, and the INRMP must be sufficiently flexible to accommodate those changes. Because the INRMP is based on guidance documents that may be periodically modified or replaced, and natural resources, which undergo constant cycling and change, periodic review and modification of the INRMP is required by AFI 32-7064 (Section 2.6-2.7), Sept. 17, 2004. According to those regulations, installations, in cooperation with the U.S. Fish and Wildlife Service (USFWS) and the Nevada Department of Wildlife (NDOW), must update the INRMP at least once every five years. Updates may also be required in shorter periods of time where changes in the military mission and changes in environmental compliance requirements significantly affect the ability of the installation to implement the INRMP. An annual review of the INRMP should be conducted by NAFB in coordination with the USFWS and NDOW in order to verify that:

- All “must-fund” projects and activities have been budgeted for and implementation is on schedule;
- Ensure that sufficient numbers of professionally trained natural resources management and law enforcement personnel are available and assigned responsibility to perform tasks associated with the preparation and implementation of the INRMP per the Sikes Act, Section 107;
- Projects and activities for the upcoming year have been identified and included in the INRMP;
- All required coordination with USFWS and NDOW has occurred; and
- Any significant changes to the installation’s mission requirements or natural resources have been identified.

The overall function of the INRMP is to implement ecosystem management at NAFB and NTTR by setting goals for attaining desired land conditions. According to AFI 32-7064, the USAF principles for eco-management include the following:

- Maintenance or restoration of native ecosystem types across their natural range where practical and consistent with the military mission;
- Maintenance or restoration of ecological processes such as fire and other disturbance regimes where practical and consistent with the military mission;
- Maintenance and restoration of the hydrological processes in streams, floodplains, and wetlands when feasible;
- Use of regional approaches to implement ecosystem management on an installation by collaboration with other DoD components as well as other state, federal, and local agencies and adjoining property owners;
- Allowance for outdoor recreation, agricultural production, harvesting of forest products, and other practical utilization of the land and its resources, provided that such use does not inflict long-term ecosystem damage or negatively impact the USAF mission. Because of security issues and mission goals at NTTR, public utilization of land is highly restricted.

Ecosystem management also includes conservation of biodiversity. This is accomplished by maintaining and reestablishing viable populations of all native plant and animal species on NAFB and NTTR when practical and consistent with the military mission. Additionally, exotic and invasive species must be controlled to prevent loss of more desirable, endemic species. Last, as part of ecosystem management, NTTR and NAFB should participate in natural heritage program support by identifying those natural communities and species at risk listed in the NatureServe Information Database. Management and mapping of these species will assist in preventing them from becoming listed as threatened or endangered in the future.

In summary, the INRMP provides guidance for the conservation of natural resources at NTTR and NAFB. These guidelines have been developed within the context of the military mission of NTTR and NAFB. The military mission takes precedence over any of the guidance provided by the INRMP but, wherever possible and feasible, the execution of the military mission may be modified in a manner to meet the goals and objectives of the INRMP.

The INRMP was prepared by 99th CES, but involved contributions from other sources. Extensive time and effort was provided by various groups within NAFB and NTTR with a substantial contribution by 98th RANW. Other important contributors to the INRMP outside of the USAF included NDOW, the Bureau of Land Management (BLM), the USFWS, and the general public.

1.2.1 Purpose

The INRMP serves as a practical management guideline for the management of the natural resources on NTTR and NAFB. INRMP development and implementation will be integrated with the development and implementation of General plan for NAFB, Comprehensive Range

Plan for the NTTR (NTTR RMP), the Intergrated Cultural Resources Management Plan (ICRMP), and the BASH Plan. The INRMP is "integrated" because

(1) It brings together Air Force mission requirements and natural resource management goals within a single document;
(2) It is integrated with other installation plans;
(3) It is derived from multiple scientific disciplines;
(4) It describes an integrated ecosystem approach to environmental management, considering information from the environment; and
(5) It restores native vegetation on NTTR to maintain realistic training areas and protect fragile desert ecosystems.

Over the years, a significant level of time and effort has been made to document various environmental aspects of NAFB and NTTR. However, these data are incomplete because of changes in the environment over time. Additionally, many gaps in the data have been identified and must now be filled to allow quality management of natural resources with respect to the Base mission. The INRMP will accomplish the following for NAFB and NTTR:

(1) Identify data gaps.
(2) Recommend and prioritize tasks to fill those gaps.
(3) Provide the framework for a new GIS database that will maintain and store current and past natural resource data in a format to be used as a tool for natural resource management of NAFB and NTTR.
(4) Most important, provide practical guidelines to assist managers in making decisions to support mission operations.

Because the INRMP must accommodate changes in the Base mission, state and federal regulations, and natural resources, the document will:

- Review past natural resource studies that are pertinent to management decisions.
- Refer to past studies and provide copies of those studies in PDF format on a Compact Disk (CD) for use by the reader.
- Provide an easily updated GIS database to catalog natural resources found on NTTR and NAFB. The GIS database can be used by resource managers on a daily basis to identify sensitive areas on NTTR and NAFB. Thus, new facilities and targets can be sited not only based on the requirements of the mission, but also can be placed to minimize impacts to the environment. The GIS database will be invaluable in developing environmental assessments, environmental impact statements, and other planning documents.
- Provide guidance to assist in decision-making.

In summary, the INRMP document will use the knowledge of past studies to develop management guidelines.

1.2.2 Goals

A primary function of this INRMP is to sustain military readiness while maintaining ecosystem integrity and dynamics on NAFB and NTTR. Maintaining ecosystem integrity promotes

good stewardship by supporting existing biodiversity, ensuring sustainable use of the installation, and minimizing management costs and efforts (Leslie et al., 1996). Ecosystem management on NAFB and NTTR is a goal-driven program that supports present and future military mission requirements while managing natural and cultural resources and supporting ecosystem integrity. It is planned at a scale that is compatible with natural processes, it is cognizant of natural processes' time scales, it is adaptable to complex, changing require-

- Realistic within the given time frame and budget; and
- Must be within the USAF realm of responsibility/influence.

Adaptive management strategies dictate that objectives are flexible and tailored to the requirements and needs at the present time. In the future, these objectives may be modified to ensure the most efficient use of time and funds as data needs and gaps become clearer. Specific objectives for this INRMP are provided within each natural resource section.

1.2.4 Monitoring and Evaluating Attainment of Goals and Objectives

The primary ecosystem management goal of scientific data collection and ecosystem monitoring will be to develop a working understanding of the structure, composition, and function of regional and installation ecosystems. Data will be collected and evaluated to support the military mission while promoting ecosystem management.

Due to the large area encompassed by NAFB/NTTR, which includes portions of two desert ecoregions, natural resource management initiatives require careful planning. Data collection and monitoring activities must focus on useful information for environmental managers. Resolution of natural resource issues conflicting with the military mission will take priority over other issues. Collection of natural resource data that can assist in management of resources with respect to the military mission is also a high priority. As in the past, collected data should be assembled in files, reports, and maps. However, because of the size of NAFB/NTTR, data must be incorporated into GIS, allowing project managers to easily review historic and current information and rapidly respond to queries for information critical to mission plans. As more data are collected and as the military mission changes or expands, 99th CES will continue to refine and develop GIS databases and models to use as tools to make sound management decisions.

The need for additional data regarding natural resources is evident. Ecosystem management requires quality data sets for the purpose of obtaining an understanding of the individual components of the ecosystem and how they interact with and affect each other. Indicator species within specific plant communities can be selected and periodically monitored to represent snapshots of the overall health of the ecosystem. Existing data from previous and ongoing studies and research efforts will be augmented with carefully designed surveys that will provide the most relevant information in the most cost effective manner. 99th CES staff is collecting and compiling ecosystem management information from diverse sources in a broad variety of disciplines to help achieve this goal. As more elements of the NAFB and NTTR ecosystem are described and catalogued in GIS, ecosystem management decisions can be easily made by managers for the daily operations of NAFB and NTTR and for proper siting of future military development of the area.

To achieve the fundamental premise of ecosystem management, other monitoring efforts will be needed. Monitoring includes activities such as surveying rare or sensitive plant populations periodically through time; periodically inventorying plant and animal indicator species; and documenting vegetational community shifts once initial survey work is completed. Monitoring allows managers to evaluate the health of an ecosystem before, during, and after management activities. Hence, monitoring will be a key tool that ensures ecosystem management actions that are environmentally sound and are developed and imple-

mented with the ultimate goal of conservation of biodiversity within the constraints of the NAFB/NTTR mission.

1.2.5 Management Guidelines

In an effort to meet the goals and objectives of the INRMP, natural resource management guidelines have been prepared. These guidelines constitute the day-to-day, working section of the INRMP. The guidelines are written in an effort to assist resource managers and other planners in making day-to-day decisions for maintenance and operation of NAFB and NTTR. Basically, the guidelines section for resource management offers recommendations, suggestions, and other information that will allow resource managers and other planners to minimize or avoid impacts to natural resources, identify environmental permitting issues, and otherwise allow for judicious management of natural resources at NAFB and NTTR. Guidelines are presented as a separate section within each natural resource section in the INRMP.

1.2.6 Authority

This INRMP is prepared under authority of AFI 32-7064 *(Integrated Natural Resources Management*, Sept. 17, 2004*)* as implemented by Air Force Policy Directive 32-70 *(Environmental Quality)* and DoD Instruction 4715.3 *(Environmental Conservation Program)*. The authority to establish natural resources management programs at DoD installations is provided by 16 USC 670 or Sikes Act (*Conservation Programs on Military Installations*). Resource-specific authority documents are listed in Table 1-1.

Protection of plant and animal species that are federally listed as threatened or endangered is required by the Endangered Species Act of 1973 (ESA), as amended (ESA; Public Law 93-205). Wildlife species that are federal candidates for listing under the ESA also receive special deliberation. The USAF and USFWS encourage the additional consideration of rare species that are not candidates for listing or are not listed as threatened or endangered. Enhanced conservation of such species may reduce the likelihood of their listing. Protection of such species may reduce the likelihood of their listing. In this document, such rare species are referred to as sensitive species or species of concern.

The Migratory Birds Treaty Act of 1918, as amended (16 U.S.C. 703-712 et seq.) implements treaties signed between the U.S. and Great Britain, Mexico, Japan, and Russia, and prohibits the take of migratory birds or any part, nest, or egg thereof, without appropriate permits. Currently, regulations do not exist to allow incidental take to otherwise legal activities; therefore, federal activities must strive to minimize such take. The Executive Order 13186 *Responsibilities of Federal Agencies to Protect Migratory Birds,* January 11, 2001, is aimed at protecting migratory birds. However, in 2002, environmental provisions in appropriations legislation (P.L. 107-315) exempted from this prohibition all taking of migratory birds during military readiness activities until regulations have been fully implemented authorizing incidental taking of these species by DoD. This INRMP will be revised to comply with those regulations when effective.

The National Wildlife Refuge Administration Act of 1966, as amended in 1997, establishes a unifying mission for the refuge system. It develops a process for determining compatible uses for refuges and provides requirements for preparing comprehensive conservation

plans for refuges. The Act states that the major mission of the National Wildlife Refuge System is focused singularly on wildlife conservation. The Act also reinforces and expands the "compatibility standard" of the Refuge Recreation Act. Thus, this Act authorizes the Secretary to permit the use of any area within the System for any purpose, including but not limited to hunting, fishing, public recreation and accommodations, and access whenever he determines such uses are compatible with the major uses for which the areas were established. The only real limitation to use is that it be compatible with wildlife. Additionally, the Act protects acquired lands from being transferred or disposed of under any provision of law. Once a piece of property becomes a wildlife refuge, it must remain so in perpetuity, with only very few exceptions. Therefore, the Desert National Wildlife Range (DNWR) located on NTTR is jointly managed by the USAF and USFWS as delineated in a Memorandum of Understanding, and Public Law 106-65 allows use of the western half of DNWR as part of the military mission.

TABLE 1-1
Natural Resource Management Authority Documents and Topics

RESOURCE	AUTHORITY DOCUMENT	DOCUMENT TOPIC
Fish and Wildlife	Sikes Act (16 USC 670 a-1[b])	Professionally trained personnel required to administer fish and wildlife management programs
	Neotropical Birds Conservation Agreement	Federal, State, and non-governmental organizations, including Air Force, conserve these birds
	Watchable Wildlife Memorandum of Understanding (MOU)	Conservation organizations and Federal agencies, including Air Force, agree to develop program
	DoD Directive 4700.4	Requires wildlife law enforcement
	Air Force Instruction 91-202	Bird-Aircraft strike hazards (BASH) program
	Air Force Instruction 32-7064	Integrated Natural Resources Management
	Air Force Policy Directive 32-70	Installations maintain species and habitat inventory
Listed and Sensitive Species	Endangered Species Act (Public Law 93-205)	Protection of Federally-listed species
	Air Force Instruction 32-7064	Protection of sensitive and state-listed species
	Air Force Instruction 32-7064	Integrated Natural Resources Management
	Executive Order 13186: Responsibilities of Federal Agencies To Protect Migratory Birds	Protection of migratory birds
	Migratory Bird Treaty Act	Prohibits take of migratory birds
	Executive Order 11990: Protection of Wetlands	Federal agencies protect wetlands

RESOURCE	AUTHORITY DOCUMENT	DOCUMENT TOPIC
Wetlands	Air Force Instruction 32-7064	Integrated Natural Resources Management
	Air Force Order 780.1	Protection of wetlands during local disturbance
	Clean Water Act Sections 401 and 404 (Public Law 95-217 as amended)	Wetland and surface water protection and documentation requirements
Floodplains	Executive Order 11988: Floodplain Management	Federal agencies protect floodplains
	Air Force Instruction 32-7064	Integrated Natural Resources Management
	Air Force Order 780.1	Protection of floodplains during local disturbance
Grounds Maintenance	Air Force Instruction 32-1053	MAJCOM must approve pesticides contracts, pesticide applications
	Air Force Instruction 32-7064	Integrated Natural Resources Management—Sections on Grounds Maintenance, etc.
	AFP 86-10	Prevention of non-point source pollution
Pest Management	Air Force Instruction 32-1053	Pesticide choices
	Public Law 93-629	Noxious weed control
	Air Force Instruction 32-7064	Integrated Natural Resources Management
	2003 Nellis Pest Management Plan	Pesticide/herbicide application
Invasive Species	Air Force Instruction 32-7064	Integrated Natural Resources Management
	Executive Order 13112 Invasive Species	Prevent the introduction and spread of invasive plant and animal species
Wild Horse and Burro Management	Wild Horses and Burros Act (16 U.S.C. 1331-1340; 85Stat. 649)	Management and control of wild horses and burros

RESOURCE	AUTHORITY DOCUMENT	DOCUMENT TOPIC
Desert National Wildlife Range	Refuge Administration Act of 1966	USFWS given responsibility of managing National Wildlife Refuges
General Land Management	National Environmental Policy Act	Lead agency of any federal action potentially impacting the environment must prepare an EA or EIS for the action.
	Air Force Instruction 13-212	Range Planning and Operations: Overall management and policy of ranges.
	Air Force Instruction 32-7064	Integrated Natural Resources Management
	PL-106-65: The Military Lands Withdrawal Act of 1999	Delineates responsibility of DoI and DoD for management of resources on withdrawn lands

1.2.7 Management Philosophy

DoD recognizes that ecosystem management, as opposed to single-species management or agricultural commodity production, can sustain the environmental integrity of their facilities (Lillie and Ripley, 1998). The overall philosophy behind the INRMP is to provide natural resource management guidance within the context of the ecosystems management concept. The goal in managing the NAFB and NTTR ecosystems is to support the military mission through conservation and enhancement of ecosystem integrity. Maintaining and improving the sustainability and biological diversity of ecosystems is a chief objective. The Nellis community assumes the important responsibility of managing the NAFB and NTTR ecosystems.

NAFB and NTTR ecosystems are representative of two of North America's most arid regions, the Mojave Desert and the Great Basin Desert. One notable result of the lack of rainfall is that vegetation growth and reproduction can be imperceptible over many years. Change in the landscape may be particularly difficult to see over less than a decade. While an ecologist taking annual measurements might be able to document demonstrable changes, an airman stationed at NAFB engaged in training on the NTTR during five years with below average rainfall may perceive no vegetational changes.

To the casual observer, the desert ecosystem appears to be unchanging and even stagnant. However, changes occur over the long term as the ecosystem matures from lower stages of succession. Dramatic changes occur when significant impacts are imposed on the environment by man and by natural events. Even in deserts, dry periods produce entirely different plant populations compared to those appearing after rains or long wet periods. Plant and animal populations may experience dramatic changes over months, years, and longer time periods as they interact with each other and respond to changes in the physical components of their habitats. Because natural resources are continually changing, their response to disturbances and management actions can be quantified after monitoring activities have been implemented. As a part of the implementation of the INRMP, monitoring programs should

be developed to define and prioritize the measurable parameters of natural resources, thus allowing for proper evaluation of the effectiveness of management measures.

The conditions that result in slow rates of biotic changes on NTTR also result in slow recovery rates for the ecosystems exposed to human-induced stresses. For example, desert pavements (areas of relatively smooth gravel and rock with little vegetation) may take thousands of years to develop. A vehicle traversing such desert pavement can strip away the rock surface and allow invasive grasses, such as red brome (*Bromus rubens*) to become established, changing the native substrate condition. Such disturbances may not return to the original, natural condition for centuries or millennia. Desert vegetation that is disturbed, whether by trampling, vehicles, grading, or ordnance, is unlikely to return to some semblance of its pre-disturbance condition during an average human lifetime without some form of active management.

The slow recovery of disturbed desert ecosystems necessitates natural resource management approaches that are patient and far-sighted. Many disturbed sites will not return to their pre-disturbance structure and function within a few years or decades as would, for example, certain habitats in the southeastern United States after a fire or hurricane. Environmental impacts imposed on natural resources by military use of NTTR will frequently be visible for many years. If such areas are to benefit from environmental restoration, remedial activities should begin at the earliest opportunity. Thus, military activities and environmental management strategies should incorporate the fact that deserts are slow to recover from disturbance, so the effects of some activities may be evident for centuries.

It is policy that the Armed Services be good stewards of the lands they utilize. This policy is currently followed on NAFB and NTTR. 99th CES implements and oversees many programs that enhance and restore the local environment. The 2.9 million acre NTTR (PL 106-65) has been used by humans only in very localized, small areas over the past 65 years. With the exception of some mining and ranching prior to withdrawal from the BLM, most areas of desert on NTTR have not been developed for residences, recreation, and other human uses that could result in extensive disturbance. Some development for military operations has occurred in isolated areas, representing less than 10% of NTTR. Because of strict control over public access to NTTR, many areas within NTTR have remained undisturbed for years and support unique plant and animal communities.

1.2.8 Conditions for Implementation and Revision

This INRMP is dynamic and has, as one objective, the integration of natural resources management with the installation's mission. For INRMP goals and objectives to be effectively implemented, guidelines provided in the INRMP should be considered early in the planning and budget processes for proposed projects and mission changes on the installation. GIS database and modeling tools recommended as part of the INRMP should be used to assist managers in the decision-making process.

1.2.8.1 Addressing Natural Resource Concerns During Planning

Information and provisions of the INRMP will be included as an annex to the *General Plan* and integrated into the *Comprehensive Range Plan* in order that natural resources will be appropriately considered in all future range and other land use planning on NAFB and

NTTR. The INRMP is a living document and will evolve as mission requirements change. The most important role of 99th CES Natural Resources Manager is to work with general planners and operators of NAFB and NTTR to ensure that developmental and operational activities run smoothly. The Natural Resources Manager should be involved early in the planning process to minimize delays that might be caused by environmental permit issues or regulations. The Natural Resources Manager can assist in conceptual designs of facilities to allow for maximum mitigation of impacts within the constraints of the mission. For example, if a project is proposed in areas known to contain desert tortoise, the Natural Resources Manager can quickly identify the level of tortoise survey work that may be required prior to construction, coordinate activities with USFWS, and assist with monitoring the site for tortoises during construction. The initiation of mission activities can then move forward with minimal delays caused by compliance to ESA.

The roles of military commands and directorates and other federal and state organizations in the management of natural resources at NTTR and NAFB are listed in Table 1-2 and will be periodically updated when significant changes in the assignment of responsibilities occurs.

1.2.8.2 Approvals and Revisions

The preliminary draft of this INRMP was reviewed by 99th CES, the installation ESOHLC, 98th RANW, the HQ ACC Environmental Analysis Branch (HQ A7VP) and other reviewers including USFWS, NDOW, and BLM. The draft plan will be distributed for public comment. The final plan will be presented to the ESOHLC and to HQ A7VP for concurrence; final approval will be obtained from the 99th ABW/CC. Component Management Plans will be approved by 99th ABW/CC and will be revised every two years or as needed. The INRMP will be revised every five years and coordinated with the USFWS and NDOW.

1.2.9 Responsibilities

Because of the presence of withdrawn lands and wildlife ranges on NTTR, the roles and responsibilities of various agencies over the management of natural resources has become somewhat complicated. 99th CES is basically responsible for ensuring that natural resources are managed properly by NTTR and NAFB within the constraints of the military mission. Additionally, 98th RANW coordinates the responsibilities and activities of the USFWS on the DNWR to ensure that those activities and responsibilities do not interfere with the military mission. 98th RANW also coordinates and schedules activities of the BLM to enable that agency to meet its responsibilities for natural resource management on withdrawn lands. Similarly, 98th RANW must coordinate the scheduling of wildlife surveys and other activities conducted by NDOW.

The NAFB, NTTR, BLM, NDOW, and USFWS have shared responsibility for the management of natural resources on NTTR in accordance with PL 106-65, the Sikes Act, National Wildlife Refuge Act, Endangered Species Act, and Migratory Bird Treaty Act. Good ecosystem management and proper adherence to NEPA, however, requires involvement of all the identifiable stakeholders (Leslie et al., 1996). Review and approval authority for the INRMP Component Management Plans and proposed actions rests with the 99th ABW/CC. The organizational chart presented in Figure 1-1 illustrates the command structure that includes 99th ABW and 99th CES. Any federal actions impacting the environment are subject to NEPA and may require consultation with federal, state, and local regulatory agencies as well

as the general public. Federal agencies, state agencies and other organizations must be consulted when plans potentially impact lands or resources jointly managed by the Air Force and those agencies or organizations (Table 1-2).

Public Law 99th106-65 requires the Department of Interior (DoI) to prepare a Resource Management Plan for NTTR. In the past, the Air Force has used the DoI's Resource Management Plan as the basis for resource management for its activities. However, under the Sikes Act, a separate plan (INRMP) is prepared by the USAF (at each air force base) to specifically address the needs and activities of the military mission with respect to natural resource conservation at the base.

1.2.9.1 Responsibilities of BLM

According to PL 106-65, the BLM has responsibility for the following on the withdrawn lands:

- Protection of wildlife and wildlife habitat;
- Control of predatory and other animals; and
- The prevention and appropriate suppression of brush and range fires resulting from non-military activities).

Additionally, PL 106-65 states the following with respect to the Secretary of the Interior and his responsibility for non-military use of withdrawn land:

> *"…shall be subject to such conditions and restrictions as may be necessary to permit 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 non-military use of the lands,* ***only with the concurrence of the Secretary of the military department concerned.****"*

The Record of Decision for the BLM Range Management Plan clearly states the role of BLM at NTTR:

> *"The emphasis of the NTTR RMP is management of the wild horse, while protecting unique habitats for threatened, endangered, and special status species, unique military training opportunities, limited recreation, as well as other resource uses. Even though habitat is limited, the BLM is committed to provide the desert tortoise with the highest possible quality of habitat. However, it must be noted that management of specified natural resources is secondary to the military mission."* (BLM, 2004A)

For NTTR, it was determined that the entire NTTR would be closed to non-military uses and the general public. BLM may manage wildlife and wildlife habitat according to their Resource Management Plan as long as resource management activities do not impact the military mission.

In summary, the responsibilities of BLM on NTTR are as follows:

- Management of the wild horse according to the RMP ROD;
- Protect unique habitats for endangered and threatened species as well as the military mission;
- Protect the desert tortoise;

- Control any wild fires on NTTR, including DNWR; and
- All responsibilities are secondary to the military mission.

1.2.9.2 Responsibilities of the USFWS

The USFWS is responsible for enforcing and administering the ESA and management of the DNWR. 99th CES/CEVN is responsible for advising military mission operators on provisions of the ESA and developing plans to minimize ESA effects on the mission.

According to PL 106-65:

> *Department of interior.-- Notwithstanding the Desert National Wildlife Refuge withdrawal and reservation made by Executive Order No. 7373, dated May 20, 1936, as amended by Public Land Order Number 4079, dated August 26, 1966, and Public Land Order Number 7070, dated August 4, 1994, the lands depicted as impact areas on the map referred to in paragraph (4) are, upon completion of the transfers authorized in paragraph (5)(F)(ii),* ***transferred to the primary jurisdiction of the Secretary of the Air Force, who shall manage the lands in accordance with the memorandum of understanding referred to in paragraph (5)(E). The Secretary of the Interior shall retain secondary jurisdiction over the lands for wildlife conservation purposes.***

The MOU between the USAF and USFWS (Service) states the following concerning the responsibilities of the USFWS on withdrawn lands in DNWR:

> "*The Service is the federal agency primarily responsible for the welfare and management of the land, wildlife and other natural resources, and for protection of cultural and archeological resources, and for research thereon in the refuge. The service is also the federal agency with specific responsibilities for protection of threatened and endangered species and management of desert bighorn sheep, desert tortoises and migratory birds."* (USFWS,1997).

Thus, responsibilities of the USFWS with respect to NTTR are the following:

- Management of natural, cultural and archeological resources on the DNWR
- <u>Conservation of wildlife resources</u> and preservation of the desert bighorn sheep within the DNWR Protection of federally listed as threatened and endangered species <u>and their habitats</u> according to the ESA
- Manage the desert bighorn sheep hunt under the direction of 98th RANW and in cooperation with NDOW

1.2.9.3 Responsibilities of NDOW

NDOW also has responsibilities for management of various natural resources within NTTR and NAFB. These responsibilities include the following:

- Control of predatory animals;
- Management of wildlife;
- Preservation of the desert bighorn sheep; and
- Assist 98th RANW with the desert bighorn sheep hunt in coordination with the USFWS.

In summary, each of the federal and state agencies having natural resource responsibilities within the boundaries of NTTR continue to have those responsibilities, but only through the final approval of 98th RANW to ensure that the military mission is not impacted and that the safety and security of NTTR is not jeopardized. 99th CES/CEVN implements provisions of the INRMP for the management of natural resources on NTTR to assist 98th RANW in ensuring that natural resources are properly managed within the constraints of the military mission and to ensure that the ecosystem is sustained for support of the military mission.

At NAFB, responsibilities for resource management are less complicated because the entire land area is owned by the Air Force. 99th ABW/CC is ultimately responsible for natural resource management at NAFB and 99th CES works under 99th ABW/CC to ensure that natural resources within the boundaries of NAFB are managed properly. State and federal agencies are involved only when NAFB activities impact state or federal regulations, and coordination with those agencies is required.

FIGURE 1-1
Organizational Chart for NAFB and NTTR

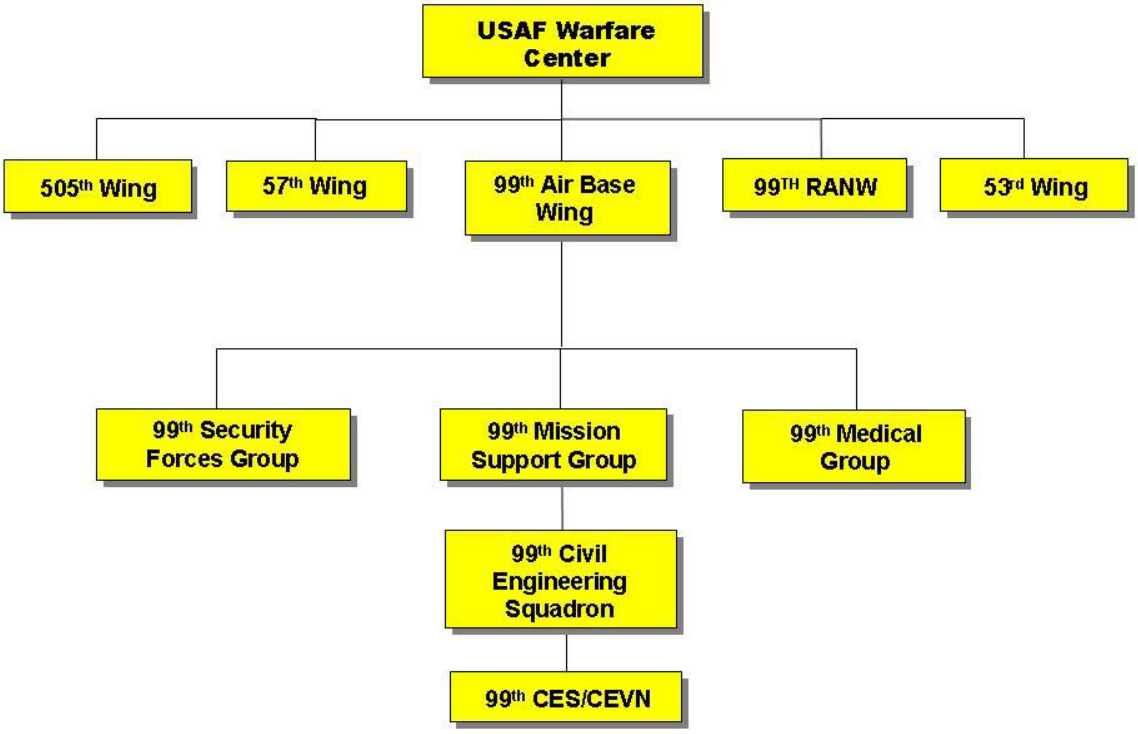


TABLE 1-2
Organizations and Roles in Natural Resources Management, Nellis Air Force Base and NTTR

ORGANIZATION	BASE	RANGE	ROLES
99th CES	Yes	Yes	• Overall responsibility for development and implementation of INRMP, Component Plans and related Environmental Assessment. • Updates and revises the INRMP and Component Management Plans. • Coordinates draft plans and projects with 98th RANW prior to execution. • Integrates the INRMP with Base Comprehensive Plan and Comprehensive NTTR Plan, BASH Reduction Plan, Cultural Resource Management Plan, and Integrated Pest Management Plan. • Develops and implements measurement and monitoring procedures. • Coordinates consultation with other agencies and stakeholders. • Ensures that NAFB and NTTR adhere to state and federal regulations pertaining to natural resources. • Coordinates natural resource management with Nellis EIAP Conservation Subcommittee, Nellis ESOHLC, 99th RANW/CC, CES, 99th ABW/CC, HQ A7VP, USFWS, NDOW, BLM, 99th SFS, and Morale, Welfare, Recreation and Services.
Nellis Public Affairs	Yes	Yes	• Reviews EA associated with the INRM. • Conducts required NEPA public notifications and public meetings. • Provides information about the INRMP to news media, elected officials, environmental groups, and interested members of the public.
Nellis EIAP Conservation Subcommittee	Yes	Yes	• Review proposed projects/management actions for EIA potential. • Review EA associated with the INRMP.
Nellis ESOHLC	Yes	Yes	• Review and initial approval authority of INRMP and subsequent additions and updates to Component Plans.

ORGANIZATION	BASE	RANGE	ROLES
98th RANW/CC	No	Yes	• Coordinate with 99th CES and facilitate Range-specific aspects of INRMP implementation. • Schedule and coordinate logistics for any natural resource management activities on NTTR. • Review and coordinate with 99th CES on proposed INRMP projects to ensure that military mission objectives are not impacted. • Coordinate the Comprehensive Range Plan and Airspace Management Plans with 99th CES/CEV. • Coordinate desert bighorn sheep hunts with USFWS and NDOW for the South Range and NDOW only for the North Range.
99th ABW/CC	Yes	Yes	Final approval authority for the INRMP.
HQ A7VP	Yes	Yes	Review INRMP, related Environmental Assessment and comment.
HQ ACC/DOR	Air Field Only	Yes	• The single focal point for all issues dealing with airfield management, air traffic control, terminal instrument procedure, and the establishment, maintenance, modification, and disestablishment of airspace and ranges for air-to-air and air-to-ground operations in Conus. • Includes the environmental, legal, public relations, and operational aspects of range and airspace management plus development of policy, planning, programming, requirement and guidance. • Reviews and concurs with all range related documents. • Final approval authority for the Range Comprehensive Plan.

ORGANIZATION	BASE	RANGE	ROLES
USFWS	Yes	Yes	• Review and concur with Component Management Plans and actions relating to DNWR lands within the NTTR. • Provide data and management input regarding desert bighorn sheep, migratory birds, and species of concern to DNWR mission. • Provide consultation with respect to Federally-listed threatened or endangered species. • Natural resources law enforcement. • Management of desert bighorn sheep. • Manages the desert bighorn sheep hunt on the South Range under the direction of 98th RANW and in coordination with NDOW.
NDOW	Yes	Yes	• Provide data and management input regarding wildlife management. • Assist NTTR and NAFB in conservation of state listed species of concern. • Control of predatory animals. • Conserve and manage desert bighorn sheep. • With the USFWS, coordinate the desert bighorn sheep hunt under the direction of 98th RANW. • Coordinate the desert bighorn sheep hunt on the North Range under the direction of 98th RANW.
BLM	No	Yes	In NTTR only: • Review INRMP and Component Management Plans; • Rangeland management; • Fire suppression and management; • Protection of wildlife habitat; • Protection of riparian areas and water sources for wild horses; • Wild horse management; and • Coordinate RMPs with 99th CES/CEV and 98th RANW/CC.
Morale, Welfare, Recreation and Services (99th Services Squadron)	Yes	No	Maintain recreation areas on NAFB.
Security Forces (99th SFS)	Yes	No	Law enforcement; security on NTTR.

1.2.10 Environmental Documentation

Implementation of the INRMP will be subject to NEPA requirements. An Environmental Assessment (EA) is provided in Appendix A of this INRMP. All relevant environmental compliance documents and historic reports or opinions will be provided in pdf format on CDs included with the INRMP.

Air Force environmental compliance review is initiated with the submittal of Air Force Form 813, the Request for Environmental Impact Analysis. Project proponents generally submit a Description of Proposed Action and Alternatives (DOPAA) in support of their submittal, enabling decision makers to have sufficient information on which to base their review and conclusions. Form 813 is completed by 99th CES, which uses the conclusions to determine the documentation necessary, if any, to fully comply with NEPA. The INRMP provides information on existing conditions and potential impacts to use in support of completing Form 813.

1.2.11 Exempted Resources

The following resources, listed as potential issues by ACC, are not found on the NAFB or NTTR, and therefore are not addressed further in this document:

- Commercial Forestry: No commercially viable forest is present.
- Coastal Zone Management: NAFB and NTTR are inland installations located in the Mojave and Great Basin Deserts.
- Agricultural Outleasing: The limited Bald Mountain grazing allotment on the Groom Range administered by BLM is the only agricultural outleasing opportunity that exists on the arid lands of NAFB and NTTR.
- Hazardous materials are contained and emergency response protocols are in place to prevent environmental damage as a result of flash floods.

1.2.12 References

Bair, J. 1997. U.S. Fish and Wildlife Service, Reno, Nevada. Personal communication.

Leslie, et al. 1996. Conserving Biodiversity on Military Lands: A Handbook for Natural Resource Managers. Arlington, VA: The Nature Conservancy.

Lillie, T. H., and J. D. Ripley. 1998. A strategy for implementing ecosystem management in the United States Air Force. *Natural Areas Journal* 18(1): 73-80.

Additional References

Bureau of Land Management (BLM). 2004. Nevada Test and Training Range Resource Management Plan and Final Environmental Impact Statement.

Bureau of Land Management (BLM). 2004A. Record of Decision for the Nevada Test and Training Range Resource Management Plan and Final Environmental Impact Statement.

Department of the Air Force. 1999. Renewal of the Nellis Air Force Range Land Withdrawal Legislative Environmental Impact Statement. Nellis AFB, Nevada.

Federal Land Policy and Management Act of 1976, as Amended. 1976. U.S. department of the Interior.

Nellis Air Force Base. 1997. Nellis Air Force Base and Range Bat Survey Report. Nellis Air Force Base, Nevada.

Nellis Air Force Base. 2003. General plan for Nellis Air Force Base.

National Wildlife Refuge Act. October 9, 1997. 16 USC Section 668dd.

Public Law 99-606. November 6, 1996. Withdrawals of Public Lands for Military Purposes.

Public Law 106-65. October 5, 1999. Military Land Withdrawal.

Sikes Act as Amended through Public Law 106-580. December 31, 2000.

United States Air Force. 2003. Bighorn Sheep Hunt Stonewall Mountain. Project Support Plan. Nellis Air Force Base, Nevada.

United States Air Force. 2003. Range Safety Assessment for Bighorn Sheep Hunt, Change 1. Nellis Air Force Base, Nevada.

United States Air Force. 2003-2004. Bighorn Sheep Hunt Southern Ranges/Alamo Project Support Plan. Nellis Air Force Base, Nevada.

U.S. Army Corps of Engineers, Omaha District. 2001. Environmental Assessment for Live Ordnance Departure Area. Nellis Air Force Base, Nevada.

USFWS. 1997. Memorandum of Understanding between the U.S. Air Force, Air Combat Command and the Department of the Interior, U.S. Fish and Wildlife Service (concerning the Desert National Wildlife Range).

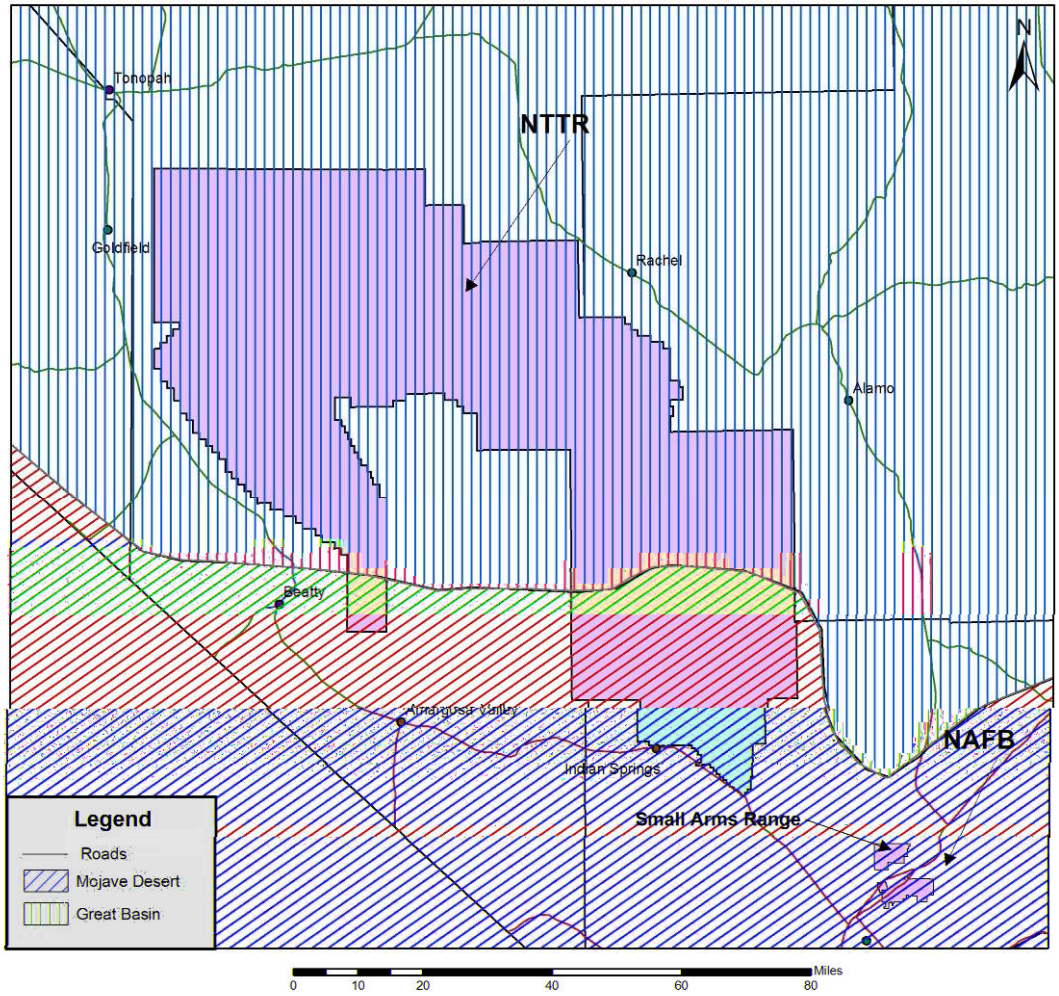
THIS PAGE IS INTENTIONALLY LEFT BLANK

2.0 INSTALLATION OVERVIEW

2.1 LOCATION AND AREA

NAFB and NTTR lie within two major geographic regions of the U.S., the Mojave Desert and the Great Basin Desert. NAFB and the south portion of NTTR lie within the Mojave Desert geographic region. The northern portion of NTTR lies largely within the Great Basin Desert (Figure 2-1). Both NAFB and NTTR are located within the Basin and Range physiographic province of the western United States (Fenneman, 1931), a region typified by broad desert valleys bounded by relatively high mountain ranges.

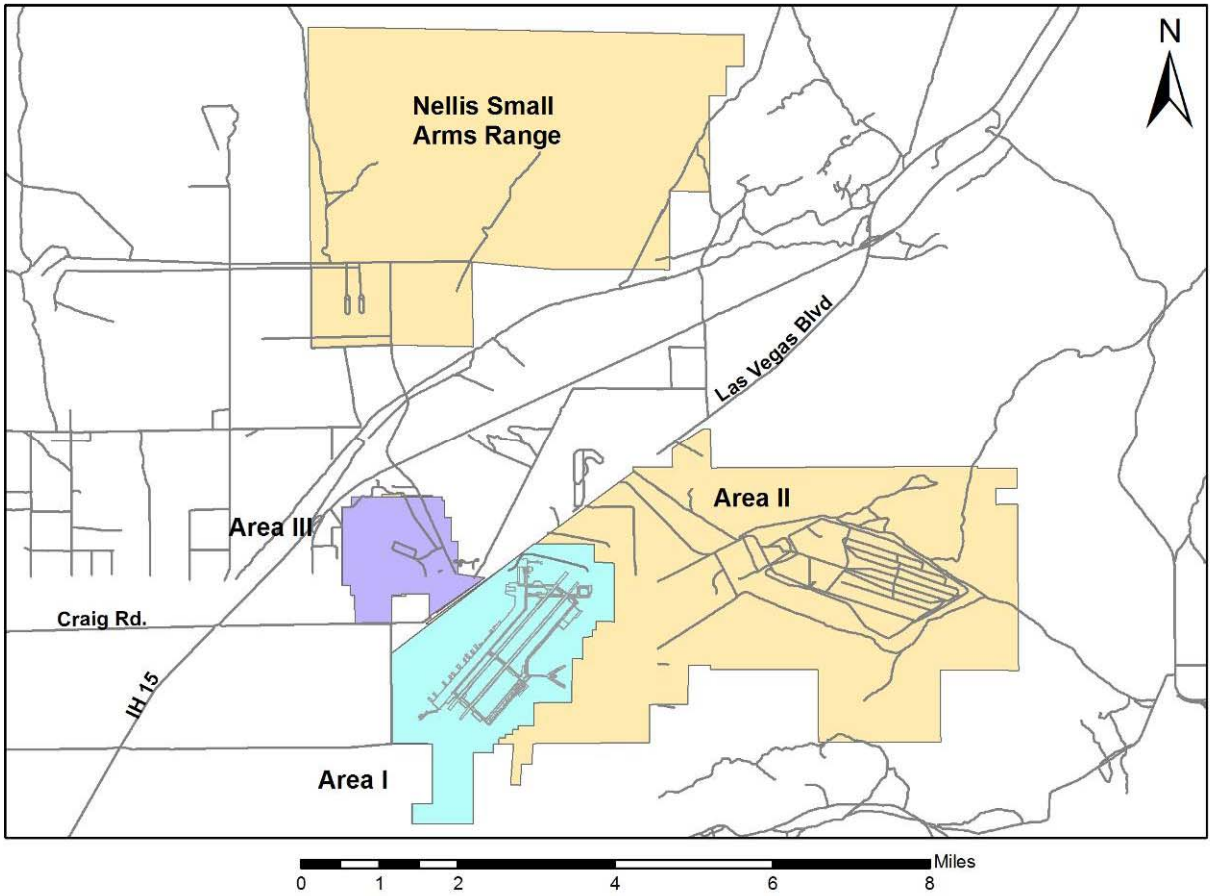
Figure 2-1. Location of NTTR and NAFB with respect to the Great Basin and Mojave Desert Ecoregions.



2.1.1 NAFB

NAFB is located northeast of the City of North Las Vegas in Clark County, Nevada. It occupies approximately 14,163 acres adjacent to the metropolitan area. The approximately 10,623-acre Nellis Small Arms Range is 3 miles northwest of NAFB on Range Road. The average elevation of NAFB is approximately 1,900 feet above mean sea level (MSL). NAFB is divided into three areas. Area I includes the NAFB facilities southeast of Las Vegas Boulevard. Aircraft facilities, administrative buildings, residential housing, recreation facilities, and personnel services are located here. Area II is in the northeast portion of NAFB and contains the 820th Red Horse squadron, Nellis Gun Club, 896th Munitions Squadron, and the largest above-ground weapons storage complex in the U.S. Area III contains NAFB facilities located northwest of Las Vegas Boulevard. It includes residences, the Mike O'Callaghan Federal Hospital, administrative areas, and industrial facilities. The Small Arms Range and the Desert Wells Annex, 0.7 km west of the main gate on Craig Road, are also managed by NAFB (Figure 2-2). The elevation of the Small Arms Range averages from 2100 ft. to 3600 feet MSL.

Figure 2-2. NAFB map showing the location of the Small Arms Range and the three management areas.



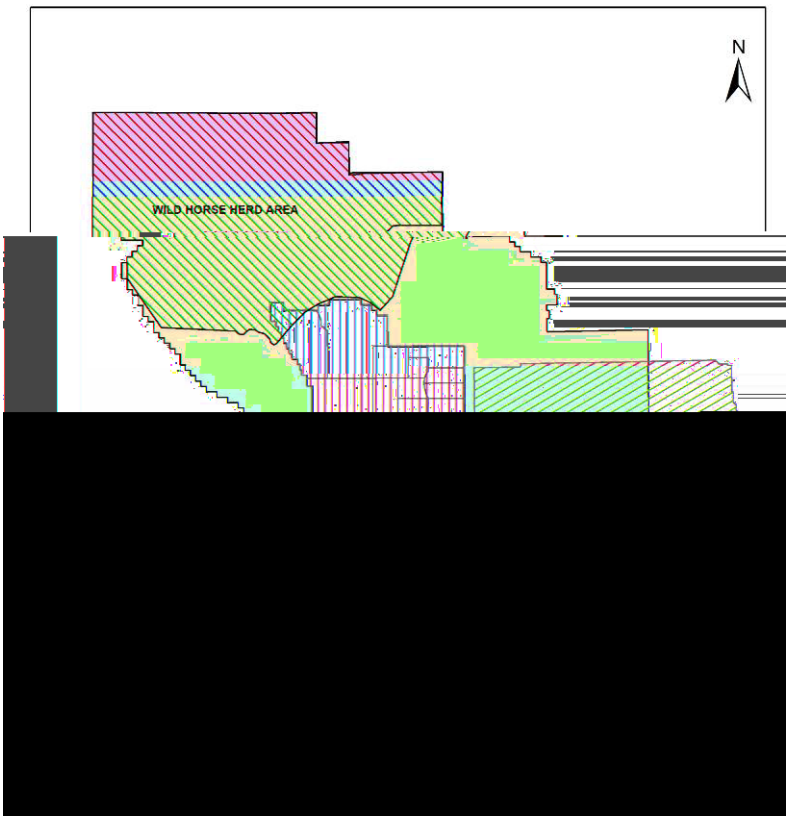
2.1.2 NTTR

The NTTR is an expansive area, covering approximately 2.9 million acres of federally-owned lands that were withdrawn from DoI-managed lands for military use under Public Law 106-65. NTTR is a unique range area because it has flying weather that is excellent year-round and it contains more than 1,600 bombable targets. Because of its size, NTTR easily provides satisfactory security and safety buffers. There is no other range like it anywhere in the world.

Section 3014 of Public Law 106-65 identifies management of the lands renewed for military mission. Section 3014 notes that "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." PL 106-65 also states that management plans will be developed by the Secretary of the Interior "after consultation with the Secretary of the military department concerned." The Record of Decision (ROD) for the BLM resource management plan for NTTR was approved on July 1, 2004.

NTTR, often collectively referred to as the "Range," is divided into two parts. The South Range occupies approximately one-third of the total NTTR lands, and the North Range accounts for the remaining two-thirds (Figure 2-3). NTTR accounts for approximately 12.4% of

Figure 2-3. Locations of areas within NTTR managed by different federal agencies.



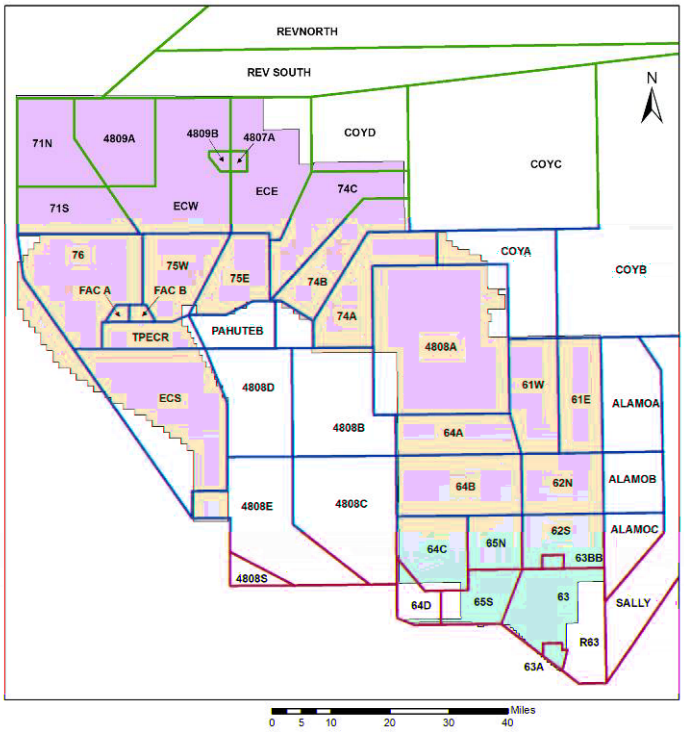
the 25,000,000 acres of domestic DoD lands, and almost one third of the 9,000,000 acres of Air Force lands in the U.S. It lies in portions of Clark, Lincoln, and Nye counties, Nevada, northwest of Las Vegas. Between the South Range and the North Range lies the Nevada Test Site, administered by the Department of Energy (DoE) (Figure 2-3). The common South Range/DNWR lands are co-managed by the Air Force and USFWS under a Memorandum of Understanding (November 1997). The North Range includes the 1,330,540-acre Nevada Wild Horse Range (NWHR). Management of wild horses on the NWHR is the responsibility of the BLM's Las Vegas District.

The named and numbered areas that make up the North and South Ranges are listed in Table 2-1 and shown in Figure 2-4. Named and numbered ranges refer to the restricted airspace above these areas that is reserved for military use.

TABLE 2-1
Named and Numbered Ranges of NTTR

Range	Sub-Ranges (Air Space)
South Range	R61E, R61W, R62N, R62S, R63, R63A, R64A, R64B, R64C, R64D, R65N, R65S
North Range	R4808A, R74A, R74B, R74C, ECE, R4807A, R4809B, ECW, R75E, R75W, FAC A, FAC B, R76, R71S, R71N, R4809A, ECS, R4808E

Figure 2-4. Named and numbered ranges located in NTTR.



2.2 INSTALLATION HISTORY

2.2.1 NAFB

From 1929 to 1941, NAFB property was used for private flight operations. At that time, the Base included dirt runways, a few buildings, and some utility service. The City of Las Vegas purchased the property in 1941 and offered it to the Army Air Corps. The Army Air Corps Gunnery School used the site for gunnery training from 1941 to 1942. The Air Force took command of NAFB in 1949. In 1950, NAFB was named Nellis Air Force Base (Paher, 1971). The Tactical Air Command assumed command of NAFB in 1958, and the Tactical Fighter Weapons Center was established there in 1966. The 554th Operations Support Wing was activated in 1979. Command responsibility for NAFB was transferred to the Air Combat Command on June 1, 1992.

2.2.2 NTTR

NTTR consists of portions of Clark, Lincoln, and Nye counties in Nevada. These lands were used by Native American groups including the Anasazi, Shoshone, and Paiute peoples. Settlement of these areas by EuroAmericans did not begin until the late nineteenth century. Cattle ranching brought small numbers of people to the area (Thompson and West, 1881; Zanjani, 1998; McMullen et al., 1995), but thousands of people came during the mining booms, especially to areas around Tonopah and Goldfield in the early part of the 1900s (Shearer, 1905; Elliott, 1966). The Mellan and Clarkdale mining districts were established in the 1930s. As the twentieth century progressed, demand for automobile access to the mines increased, which brought more roads into areas that were to become NTTR (Shearer, 1905; Carpenter et al., 1953; Zanjani, 1998).

NTTR was originally established in 1940. The airfields and additional military lands that developed into the Nellis Range Complex were expanded piecemeal between the 1940s and 1960s. A December 1949 agreement with the USFWS permitted military utilization of part of the Desert Game Range (established in 1936), stretching northwest from Las Vegas, over the Las Vegas, Sheep, and Pintwater Mountain Ranges. This area has subsequently been used by the military for air-to-ground and air-to-air bombing practice. Plans were first drawn up in December of 1941 to develop Indian Springs as an AT-6A training center (land having been granted on Sept. 22, 1941), but it was not until February of 1943 that construction began including nearly 50 buildings, "100 tents, and two cantonments [that] housed 1,118 men." Use of the Indian Springs Air Field slowed after June of 1945 as the Fixed Gunnery Department was closed, and finally the field was terminated that December. Under the Department of the Air Force, NAFB, which itself was inactive between 1947 and 1949, reactivated Indian Springs in October of 1950, calling it the Indian Springs Air Force Base, later to be renamed the Indian Springs Air Force Auxiliary Field (CREECH AFB) in April 1964 (NAFB, 1993a).

On the North Range, the Tonopah Test Range (TTR) was among the areas designated by President F. D. Roosevelt and the Office of the Chief of the Air Corps in 1940-1941 to be included in the Las Vegas Bombing and Gunnery Range. This effectively "cleared up civilian titles in areas near Tonopah, Nevada" (NAFB, 1993a), and in August of 1941, some 2,500 acres were transferred to NAFB jurisdiction. More than 82,500 acres were added in 1963, and currently NTTR comprises about 2.9 million acres. Originally developed as a

training center for Army pilots, the adjacent Tonopah Army Air Field served over 6,000 personnel in 1940. TTR was developed by the Atomic Energy Commission in 1957, and the four Roller Coaster events "were carried out in 1963 and resulted in plutonium contamination of four areas totaling about 193 acres" (SAIC/DRI, 1989). Several divisions of NTTR are utilized for electronic warfare, which began in 1975. The Stealth F-117A program was developed at the TTR (as acknowledged in 1988), and its 37th Fighter Wing was inactivated in 1992.

Currently, NTTR is used for training, testing, and weapons evaluation operations for the USAF, U.S. Army, U.S. Marine Corps, U.S. National Guard, U.S. Navy, DoE, reserve forces, and other federal agencies. Foreign military allies of the United States also train some of their forces here.

2.3 LAND CLASSIFICATION WITHIN NTTR AND NAFB

The combined area of military, public domain, easement, in lease, and temporary use lands, for which NAFB and NTTR maintains accountability records, totals 3,130,106 ac. This total includes NAFB proper, NTTR, Indian Springs Air Force Auxiliary Field (CREECH AFB), Nellis Small Arms Range Annex, Mt. Sunrise Obstruction Lights Annex, Nellis Water System Annex, Apex Communications Annex, Nellis Communications Annex, Tonopah Air Force Station, Tonopah Auxiliary Airfield, Tonopah Auxiliary Airfield #1, Tonopah Auxiliary Airfield #2, Warm Springs Radio Relay Site, and Warm Springs Storage Site. Land usage details are presented in Table 2-2 as provided by NAFB real estate in an NAFB 7115 Information Sheet dated 8/4/2004 with 16 acres of additional land added to NAFB.

NAFB and NTTR lands are classified and subsequently managed using three land use categories: improved land, semi-improved land, and unimproved land. Of the total area managed by NAFB and NTTR, over 99% is unimproved land. Semi-improved lands account for about 0.1% of the total, and improved land accounts for about 0.03%. Most improved and semi-improved lands are on NAFB (NAFB, 1996a). The following characterizations can be made regarding the land types:

- **Improved lands** - This classification includes areas that have been developed for administration, housing, other building projects, and organized recreation (golf courses, ball fields, etc.). Vegetation on improved lands requires constant maintenance to ensure survival in the local arid climate. On NAFB, the major turf grass is a combination of Kentucky bluegrass, ryegrass, and fescue. Improved lands are regularly mowed and irrigated throughout the year and aerated twice a year. Weeds and brush are controlled with herbicides, as required. Trees and shrubs are pruned at least annually. Insecticides are applied in and around buildings as needed. Appropriate chemicals or traps are used for rodent control, if rodents become a nuisance or impede the military mission.

- **Semi-improved lands** - Semi-improved lands on NAFB and NTTR usually include areas that are located in proximity to runways, airfields, fence lines, parking ramps, and minimally developed spaces such as open storage areas. Most semi-improved lands are not grass seeded; those areas with grass are irrigated and mowed during the grow-

ing season. Mowing also controls weeds and brush, which is important for reducing fire-hazard fuels. Trees and shrubs are pruned when needed. Rodents are controlled near runways and open storage areas. Semi-improved lands are not aerated, nor scheduled for insect control.

- **Unimproved lands** - The majority of land within NAFB and NTTR is unimproved. Since these areas are not currently scheduled for development or building sites, they are not included as a part of the NAFB *Land Management Plan*. These lands are not scheduled for mowing, irrigation, aeration, pruning, or insect control.

TABLE 2-2
Land Classifications (in acres) of Nellis Air Force Base and NTTR

NTTR OR NAFB	INSTALLATION	TOTAL AREA (acres)	NATURAL RESOURCE CHALLENGES	TYPE OF CHALLENGE
NAFB	Apex Communication Annex	1	No	None
NTTR	Creech AFB	2,300	Yes	DT; RP
NAFB	Nellis Communication Annex	2	No	None
NAFB	Mt. Sunrise Obstruction Lights Annex	11	No	None
NAFB	NAFB	14,147	Yes	DT; RP; SOC; JWUS
NTTR	NTTR	3,092,316	Yes	DT; RP; SOC; JWUS; WH; RH
NAFB	Nellis Small Arms Range Annex	10,623	Yes	DT; SOC; RP; JWUS
NAFB	Nellis Water System Annex	107	No	None
NTTR	Tonopah Air Force Station	47	No	None
NTTR	Tonopah Auxiliary Airfield	2,157	Yes	None
NTTR	Tonopah Auxiliary Airfield #1	1	No	None
NTTR	Tonopah Auxiliary Airfield #2	109	Yes	Unknown
NTTR	Warm Springs Radio Relay Site	265	Yes	Unknown
NTTR	Warm Springs Storage Site	336	Yes	Unknown
	TOTAL:	3,130,106		

Abbreviations: DT (Desert Tortoise); SOC (Species of Concern); RP (Rare Plant); JWUS (Jurisdictional Waters of the U.S.); WH (Wild Horses); RH (Riparian Habitat)

Source: NAFB Real Estate in an NAFB 7115 Information Sheet dated 8/4/2004. NAFB real estate no longer classifies land used for the Air Force, instead using only acreages of total land.

2.4 MILITARY MISSION

As mentioned previously in this document, NAFB is an integral part of the USAF's ACC. Known as the "Home of the Fighter Pilot," NAFB represents the pinnacle of advanced air combat aviation training for composite strike forces. NAFB's all-encompassing mission is accomplished through an array of aircraft, including the A10; F-15C; F-15E; F-22A Raptor; F-16; MQ-1A and MQ-1 Predator UAVS; HH-60G helicopters; and every other type of aircraft in the Air Force inventory. Training is commonly conducted in conjunction with air and ground units of the Army, Navy, Marine Corps, and allied forces from throughout the world.

The USAFWC is an intermediate headquarters for five wings and 24 detachments. It conducts the Air Force's most advanced weapons and tactics training for a wide variety of specialties and includes Red Flag and the USAF Weapons School. The USAFWC also conducts operational testing and tactics development and evaluation for combat weapons systems, and it supports combat search/rescue and unmanned aerial vehicle reconnaissance operations worldwide. It operates and maintains the NTTR, Leach Lake Tactics Range, and two geographically separated airfields.

The USAFWC oversees operations of the 57th Wing, 98thth Range Wing, 99thth Air Base Wing, the 53rd Wing at Eglin Air Force Base, and the 505th Command and Control Wing at Hurlburt, as well as the Unmanned Aerial Vehicle Battlelab at Creech AFB and the Air Warfare Battlelab in Idaho. A list of the military units supported by the USAFWC and a brief description of the mission of each is provided in Table 2-3.

TABLE 2-3
USAFWC Military Units and Missions at NAFB and NTTR

57th Wing	
Oversees missions for all flying operations at NAFB including the USAF Weapons School, "Red Flag" and "Air Warrior" training, the USAF Air Demonstration Squadron (Thunderbirds) and the USAFWC's test and evaluation activities.	
Military Unit	**Mission**
57th Operations Group	Supports NAFB's flying operations with air traffic control services, base operations support, airspace management and weather services. Responsible for scheduling, training, life support, adversary support, weapons, tactics, and planning staff functions.
547th Intelligence Squadron	Provides intelligence support for 57th Wing and 99thth Air Base Wing. Evaluates threat to aircrews and publishes documents and reports used DoD-wide. Plays an integrated role in the Aerospace Integration Center providing space-derived intelligence to the NAFB community. Operates the USAF's only hands-on Threat Training Facility.
414th Combat Training Squadron (Red Flag)	Conducts exercise scenarios that maximize the combat readiness and survivability of participants by providing a realistic training environment. Combat units from the U.S. and several allied countries engage in combat training scenarios.

11th, 15th, and 17thReconnaissance Squadrons Air Force Special Operations Command	Provides theater commanders with deployable long-endurance, real-time aerial reconnaissance, surveillance, and target acquisition flying the MQ-1A Predator. Reports battlefield conditions to warfighters in addition to collecting and distributing imagery products to commanders in chief and national level leadership.
USAF Joint Air Ground Operations Group	Provides instruction in concepts, doctrine, control systems, and procedures for air and surface force integration. Executive agent for Air Warrior exercise program; provides joint, combined, and total force training at U.S. Army combat training centers.
57th Maintenance Group	Performs safe and reliable maintenance on more than 108 A-10A, F-15C/D, F-15E and F-16C aircraft and HH-60G helicopters assigned to the 57th Wing.
57th Operations Group	Provides support for the Predator operations at Creech AFB.
57th Adversary Tactics Group	Provides support for NAFB flying operations, exercise scenarios, and combat training for NAFB and NTTR.
USAF Advanced Maintenance and Munitions Officers School	Provides graduate-level instruction to logistics officers in the integration of expeditionary logistics processes at the tactical level.
USAF Weapons School	Teaches graduate-level instructors courses that provide the world's most advanced training in weapons and tactics employment to officers of the combat air forces.
USAF Air Demonstration Squadron – Thunderbirds	Plans and presents precision aerial demonstrations in front-line multi-role fighter aircraft, the F-16 Fighting Falcon. Demonstrates to the public the professional competence of Air Force members, supports the Air Force community relations, and supports Air Force recruiting and retention programs.

99th Air Base Wing

Serves as host wing for NAFB. Oversees day-to-day operations such as personnel, finance, civil engineering, and supply.

Military Unit	Mission
99thth Comptroller Squadron	Provides professional financial management services to organizations and individuals at NAFB.
99thth Medical Group	Provides medical care for the military community to ensure maximum wartime readiness and combat capability.
99th Security Forces Group	Provides and administers security for NAFB and NTTR.
99thth Mission Support Group	Six squadrons that operate and maintain NAFB and provide base-level support such as security, law enforcement, communications and computer systems, visual information, information management, education, billeting, family housing, fire production disaster preparedness, and facilities engineering support.

98th Range Wing	
Operates, maintains, and develops the NTTR. Supports DoD advance composite force training, tactics development, and electronic combat testing as well as DoD and DoE testing requirements and research and development. Hosts numerous Red Flag and USAF Weapons School exercises each year, as well as various test and tactics development missions. Serves as the single point of contact for NTTR customers.	
53rd Wing	
Located at Eglin Air Force Base, FL. Serves as the focal point for the combat air forces in electronic combat, armament and avionics, chemical defense, reconnaissance, command and control, and aircrew training devices. Responsible for operational testing and evaluation of new equipment and systems proposed for use by the forces.	
Military Unit	**Mission**
422nd Test and Evaluation Squadron	Supports six different flights of fighter and helicopter aircraft: A-10, F-15C, F-15E, F-16C, F-22A Raptor, and HH-60G. Conducts operational tests for ACC on new hardware and upgrades to each of the five aircraft in a simulated combat environment.

2.4.1 Natural Resources Required to Support the Military Mission

The military mission at NAFB and NTTR requires large expanses of land that are remote and are not developed or inhabited by non-military personnel. Much of the area is used for target and warfare maneuvers practice. A large buffer between the public and target or practice areas is required for security and safety.

At times, the general topographic and vegetative features of the area may also mimic features in other foreign countries where the military may be involved or potentially involved. These areas can be used as the setting for practicing military maneuvers that may be used in those foreign countries. Thus, the most important natural resource used by the military mission is the remoteness and the general physical and biotic character of the area. No other natural resources are required to a significant extent. At times, the mission may impact vegetation on NTTR and it is extremely important to restore native vegetation on NTTR to maintain and conserve these fragile desert ecosystems.

2.4.2 Effects of the Military Mission on Natural Resources

Many of the activities involved in meeting the goals and objectives of the military mission have impacts on natural resources. These impacts are discussed in detail in the March 1999 Legislative Environmental Impact Statement for the Renewal of the Nellis Air Force Rangeland Withdrawal. A summary of the findings is discussed in the paragraphs that follow.

2.4.2.1 Noise

Relatively extensive noise models and studies were conducted to determine baseline noise levels at NTTR and NAFB and to determine if the noises emanating from mission activities

could have a significant impact on the environment. Sources of noise specifically studied at NTTR included subsonic noise, sonic booms, and noise from high explosives in ground activity. It was concluded that mission activities did not significantly increase noise levels above baseline determinations. Additionally, none of the noise levels projected for NTTR was sufficiently high to impact wildlife and other natural resources.

2.4.2.2 Fire

Certain military activities can result in brush fires, which, in turn, impact natural resources. Specific mission activities potentially causing fire include exploding ordnances, aircraft crashes, and flares. USAF has a responsibility under PL 106-65 to take the necessary precautions to suppress wildland fires caused by military operations. Procedures have been developed to minimize the potential for causing fires at NTTR.

2.4.2.3 Hazardous and Toxic Materials

NAFB and NTTR personnel routinely use hazardous and toxic materials in their operations. These materials include paints, solvents, thinners, adhesives, aircraft fuel, diesel, gasoline, lubricants and oils, hydraulic fluids, cleaners, batteries, acids, refrigerants, herbicides, insecticides, rodenticides, and compressed gases. The Air Force Pollution Prevention Plan minimizes the potential impacts of these hazardous and toxic materials on the environment. The mission also produces non-hazardous solid waste that is collected and disposed of properly, causing little or no impacts to natural resources.

2.4.2.4 Geology and Soils

Mission activities are not anticipated to impact the geology of NTTR. The use of ordnance and vehicles on NTTR results in ground disturbance, which exposes soil to wind erosion. Impacts to soil can be minimized by following best management practices currently enforced by the mission.

2.4.2.5 Water Resources

Surface waters on NAFB and NTTR are limited due to the low precipitation. Most of the surface water features are associated with springs or seeps in the North Range, with some in the South Range. The mission activities are not expected to impact those surface waters. However, many activities associated with the mission may impact ephemeral streams, which flow throughout NTTR and NAFB. These streams are only periodically inundated by stormwaters. Most of the ephemeral streams found on NAFB are connected to surface waters of the U.S. and would be considered jurisdictional by the U.S. Army Corps of Engineers (USACE). Most of the streams in NTTR flow into closed basins and are not connected to navigable waters of the U.S., making them non-jurisdictional waters of the U.S. Some of the streams on the west and south side of NTTR flow into navigable waters and may be jurisdictional. Activities potentially impacting jurisdictional streams include road construction, pipeline and utility installation, target construction, and construction of buildings or other facilities. Similar mission activities may impact floodplains, but those impacts can be minimized if proper procedures are used. The military mission is not expected to impact groundwater.

2.4.2.6 Vegetation

Activities causing potential impacts to vegetation include air to ground gunnery and bombing practice at targets, maintenance and placement of targets and threat simulators, ground training, and the use and maintenance of roads and utility lines. These activities occur primarily in areas that have already been disturbed, with additional ground disturbance only likely to occur around the edges. Again, most of this disturbance is concentrated on playas where biological resource values are low and impacts are minimal. The mission impacts less than 10% of the total land area of NTTR and NAFB, which means that most of the vegetation on NTTR remains non-impacted. Thus, many rare plant populations are being conserved. Current plans indicate that the mission may be using mountainous areas on NTTR which may result in potential impacts to rare plant communities in those areas. More careful planning prior to mission activities may be involved to locate and avoid rare plant populations.

2.4.2.7 Wildlife

Impacts to wildlife on NTTR and NAFB mostly result from on-the-ground activities, which include continuing use of range targets, ground facilities, training areas, and roads. Most of these areas lie in valleys and on bajadas and contribute approximately 5% of the land area of NTTR. Although the mission may cause significant impacts to isolated areas, loss of some habitat resulting from mission activities could be expected to continue. Impacts to isolated areas can result in negative impacts to populations of less mobile species such as the desert tortoise and species that require unique habitat for breeding or nesting, such as desert bighorn sheep, bats, raptors, waterfowl, sage grouse, falcons, and others. As the mission increases its activities in mountainous areas, locating and monitoring wildlife populations will be critical to minimize impacts to those populations.

Beneficial impacts also result from exclusive military use, which does not allow livestock grazing, agricultural use, off-road vehicle use, private land development, or public use. These regulations would continue to bring posit

TABLE 2-4
Military Activities on NTTR That Could Potentially Impact Natural Resources

ACTIVITY	EFFECT	REMARKS
Flight operations	Noise	May affect some species of vertebrates. Degree of effect on desert bighorn sheep has been researched on NTTR and at Mountain Home AFB, ID. Supersonic levels do not affect environments.
Ground operations	Fuel spills	Personnel are trained in spill containment at NTTR and NAFB facilities. Hazardous materials are collected and disposed of in compliance with RCRA.
Air-to-ground attack training (including chaff and flares)	Soil disturbance, elimination of vegetation cover, invasive species establishment	Disturbance, including fires, may reduce or eliminate vegetation. Impact and detonation of ordnance may injure, damage, reduce, and/or eliminate both vegetation and animals, with indirect effects being altered long-term vegetative succession and associated reduction in use of a site by animals until the habitat restores itself. Target areas are subject to clean-up and restoration, which impact the environment with excavation and clearing activities as well as disturbance caused by personnel, vehicles and equipment.
Air-to-ground attack training	Contamination from explosives	Limited to target areas. The target areas are usually located in playa lakes supporting low densities of vertebrate populations, so impacts to wildlife are minimal. Minimal human exposure. Plant uptake of contaminants is not known and the impact to animals ingesting plants cannot be determined at this time. Animals potentially impacted when dry lake beds containing targets fill due to rain.
Crash site and cleanup	Soil disturbance, contamination with explosives and fuels/lubricants, potential of fire, elimination of some vegetation	Occasionally, aircraft, drones, and missiles may crash or land off-target. These incidences are uncommon, but can impact almost any area on NTTR, including sensitive areas. Crash sites are typically cleaned of contaminated material and all aircraft or missile parts. Fuel spills from crash sites are usually allowed to naturally attenuate.

ACTIVITY	EFFECT	REMARKS
Surface activities	Soil disturbance, compaction, and crushing	Vehicle travel is mostly restricted to established roadways except in target areas where personnel, equipment, and vehicles may travel off-road for removal of ordnance. New road installation may impact plants and animals.
Facilities development and target construction	Soil disturbance and compaction, elimination of vegetation	Environmental impacts caused by the construction and operation of all facilities must be assessed prior to initiation of any work according to NEPA regulations, Air Force guidance, and other relevant authority. Cooperative environmental-NTTR development planning is conducted to minimize impacts on natural resources.

2.4.3 Potential Impacts of the Military Mission on Natural Resources in the Future

The importance of NAFB and NTTR to national security increased in the 1990s due to the closure of other Air Force facilities in the United States. The vast, largely undeveloped NTTR in the desert of Nevada offers unique training opportunities to modern fighter pilots that are difficult, if not impossible, to reproduce elsewhere. Given that aircraft use will remain constant or increase in the foreseeable future, it is unlikely that either ordnance use or aircraft noise will be reduced on NAFB or NTTR.

Current policies regarding pollution, and the active involvement of the Environmental Management Directorate and other Air Force organizations in these issues, are reducing the volume of wastes that were allowed to accumulate in the past and will result in further reductions in the future. Efforts to remediate contaminated areas are extensive and ongoing. New technological measures, such as petroleum absorbent pads and booms, are employed today for controlling the spread of accidentally leaked or spilled petroleum products and solvents.

2.4.3.1 Installation Restoration Program (IRP) Sites

In support of the military mission over the years, large volumes of petroleum products, solvents, and protective coatings have been used on NAFB and NTTR, resulting in the generation of wastes. Some of these materials are intrinsically hazardous or toxic, or have become so with time. Underground Storage Tanks (USTs) are present on NAFB and NTTR. The USAF established the Installation Restoration Program (IRP) to plan and implement remedial actions to mitigate the effects of these materials on the environment. The IRP sites are described in detail by the *Management Action Plan* (NAFB, 1997a) for NAFB and NTTR. The types of sites addressed by the IRP include ordnance trenches, disposal pits, landfills, surface spills, storage terminals, fire training sites, waste ponds, and storm drains. Since 1982, 144 IRP sites have been identified: 46 on NAFB; 68 on NTTR; 13 at CREECH AFB;

and 17 at TTR. The sites on NTTR and at TTR did not require remediation. On NAFB, 12 sites required remediation, and nine of those are still being remediated. The two sites requiring remediation at CREECH AFB are still active. In general, the IRP sites are not expected to pose human health risks (NAFB, 1997a). Initial studies of potential NTTR target threats to environmental health are presented in the *Range Contamination Report* (NAFB, 1996b).

2.4.3.2 Ordnance

Because of the nature of the military mission of NTTR and NAFB, ordnance delivered on the range has very localized impacts to the environment. Since the majority of targets are located in playas, impacts to wildlife and plants are minimal. Wastes from ordnance explosions may be found on the surface, underground due to the force of the original delivery or from the physical actions of wind and water, or in burial pits where quantities of ordnance-related wastes were collected. All ordnance burial pits are presently IRP sites. These sites are closed according to environmental regulations of the State of Nevada. The practice of using burial pits has been discontinued since the mid-1980's. Air Force Explosive Ordnance Disposal (EOD) personnel actively clear ordnance on NTTR as part of the Coronet Clean program. Waste ordnance has little potential for spontaneous combustion or for detonation from wildlife activities. Ordnance items do, however, represent a safety hazard for personnel, and specific safety courses are required for persons operating on NTTR. Because of numerous factors, surficial soil contaminants would not be expected to move off NTTR. Additionally, based on the results of the recent sampling programs at representative target complexes, explosive and metal residues associated with expended ordnance appear to be restricted to the areas immediately around the target areas (NAFB, 1996b). Thus, further research to understand ecological risks, if any, associated with NTTR ordnance contamination may be desirable.

2.4.3.3 Noise

Noise impacts on NAFB have been evaluated, and the results were presented in an *Air Installation Compatible Use Zone* (AICUZ) study under the direction of the Base Civil Engineer. Decibel contours were defined around the airfield as part of that study. Aircraft noise may be heard most weekdays on the NAFB and NTTR.

A study on subsonic noise on NTTR was conducted, and results were reported in *Assessment of the Subsonic Noise Environment in the Nellis Range Complex* (NAFB, 1993b). Four distinct noise level grids were compiled into a composite grid. For all airspace studies, the maximum Rate Adjusted Day/Night Average Sound Level was found to be within acceptable land-use compatibility guidelines.

Large blocks of airspace near NAFB that can be used to train flight crews at supersonic speeds below Flight Level (i.e., below 30,000 ft above MSL) are required by ACC. Therefore, an EA was produced to analyze potential impacts of supersonic flight over NTTR. Supersonic flight results in a type of noise known as sonic booms. The EA concluded that the continuation of supersonic flights over NTTR would not have a significant impact on the environment (NAFB, n.d.).

2.4.3.4 Hazardous Wastes

NAFB and NTTR personnel that may come in contact with hazardous wastes are given specific training for avoiding, handling, and disposing of such materials. Aircraft hangars are equipped with oil-water separators, which capture and collect generated waste petroleum products and solvents. An Initial Accumulation Point course is provided for managers, consistent with the federal Resource Conservation and Recovery Act (RCRA). Introductory courses for technicians, focusing on materials used on the flight line, and refresher courses for more senior personnel are also provided. These courses direct personnel to limit handling of petroleum products and other hazardous wastes, to gather the wastes in proper storage, and to assemble larger than 55-gallon quantities at designated accumulation points. NAFB has the necessary RCRA Part B permits to accumulate hazardous wastes in order to make pick-up more economical. A review of hazardous materials handling on NTTR was conducted and a final report was issued in April 1996 (NAFB, 1996c). In addition, a *Storm-Water Pollution Prevention Plan* has been prepared by 99th CES personnel. This plan provides methods to eliminate or reduce pollution in local surface and groundwater sources, should any hazardous materials be inadvertently released.

An assessment of Tonopah Test Range, Point Bravo, and CREECH AFB was conducted to address the potential for and impact of an aboveground storage tank release on drinking water intakes and sensitive fish and wildlife habitats. NTTR and the CREECH AFB required this assessment for compliance with the July 1, 1994 Final Rule which amended 40 CFR, Parts 9 and 112 of the Oil Pollution Act of 1990. Upon review of possible affected sensitive fish and wildlife areas, drinking water intakes, planning calculations, and current spill contingency plans, a Facility Response Plan was deemed unnecessary. A Certification of Substantial Harm Criteria will be completed and maintained with each of the facility Environmental Coordinators and with 99th CES. This certification is presently being updated and will be reviewed annually with the *Base Facility Response Plan*.

2.4.3.5 Infrastructure

Much of the land area on NAFB, and a small portion of the NTTR, is occupied by roads, utility corridors, buildings, housing, and land used for aircraft operations and maintenance. The infrastructure causes direct losses of ground cover and disturbance to adjacent areas, an effect seen most directly on NAFB. Roads and utility corridors fragment habitats and can provide human access to previously undisturbed areas. Habitat fragmentation and disturbance of remote areas are important considerations in natural resource management (Noss and Cooperrider, 1994), particularly of NTTR. The fragmentation of natural habitats due to man-made infrastructure, such as roads, ditching, and utilities, was identified as a specific concern of the Keystone Dialogue. The participants identified the importance of intact habitats to ecosystem health, and the 99CES/CEVN makes every effort to limit new non-mission essential construction and to close unused infrastructure, such as non-mission essential roads, wherever possible.

2.4.4 Natural Resources Constraints to the Mission and Mission Planning

Ecosystem integrity is of primary importance to 99th CES when considering new projects, either internally or for other wings or directorates. Any non-mission essential project which interferes with natural processes is undesirable and avoided whenever possible. An exam-

ple is construction of a new road that transects a previously undisturbed alluvial fan. Such construction would have the potential to interrupt natural surface hydrology and vegetation distribution. Such planning requires knowledge of both the natural systems on NAFB and NTTR and the required man-made infrastructure. Maintaining or promoting ecosystem integrity can be greatly enhanced by use of centralized access to available databases, especially through the use of GIS.

To facilitate effective ecosystem management for NAFB and NTTR, impacts of military operations on natural resources must be understood and an appropriate management framework must be developed. Biodiversity objectives will be integrated into these management strategies. Proactive management of the BASH issue must continue. To the extent feasible, new construction/expansion projects on NAFB must consider and avoid impacts to priority populations of resident plant and animal species in their planning and management designs, if the location is not mission essential. Landscaping at new construction areas and some existing facilities should shift to the use of xeric native species where possible, especially where development interfaces with native habitat. Sensitive species, such as the federally listed desert tortoise and the state listed Las Vegas bearpoppy must also be considered during planning and site selection, and decision-making processes. For this reason, the 99th CES maintains a map of biologically sensitive areas. Additional resource information as it becomes available, integrated with sensitive biological area maps, will greatly enhance the decision making process. Such updated information can be stored digitally and made available through the shared GIS.

2.5 SURROUNDING COMMUNITIES

NAFB is located in a relatively well-developed area on the northeast side of Las Vegas. Las Vegas lies in Clark County, which has a population of 1.376 million (2000 census), and it is one of the fastest growing areas in the United States. The north and east boundaries of NAFB are undeveloped areas mostly owned and managed by the BLM. To the west of NAFB is North Las Vegas, with a mixture of residential and commercial land use. North Las Vegas has a population of over 115,488 (2000 census), with a major portion of its land area devoted to commercial and industrial development. South of NAFB is a commercial/industrial area, with some residential areas to the southeast.

Because of the high growth rate of Las Vegas, the potential for continued development of land to the east and south of NAFB is high. Encroachment of development around NAFB is doubtful because of acquisition of lands by NAFB and management of land to the east by BLM.

NTTR is very remote, with only a few small towns (including Tonopah, Beatty, Indian Springs, Goldfield, Alamo, Hiko and Rachel) located near the boundaries. Encroachment of development by these towns on NTTR is not likely. However, Nellis should continue to work with the towns near the range and in the military operating areas to ensure communities understand the necessity of mission activities.

2.6 LOCAL PROMINENT NATURAL AREAS

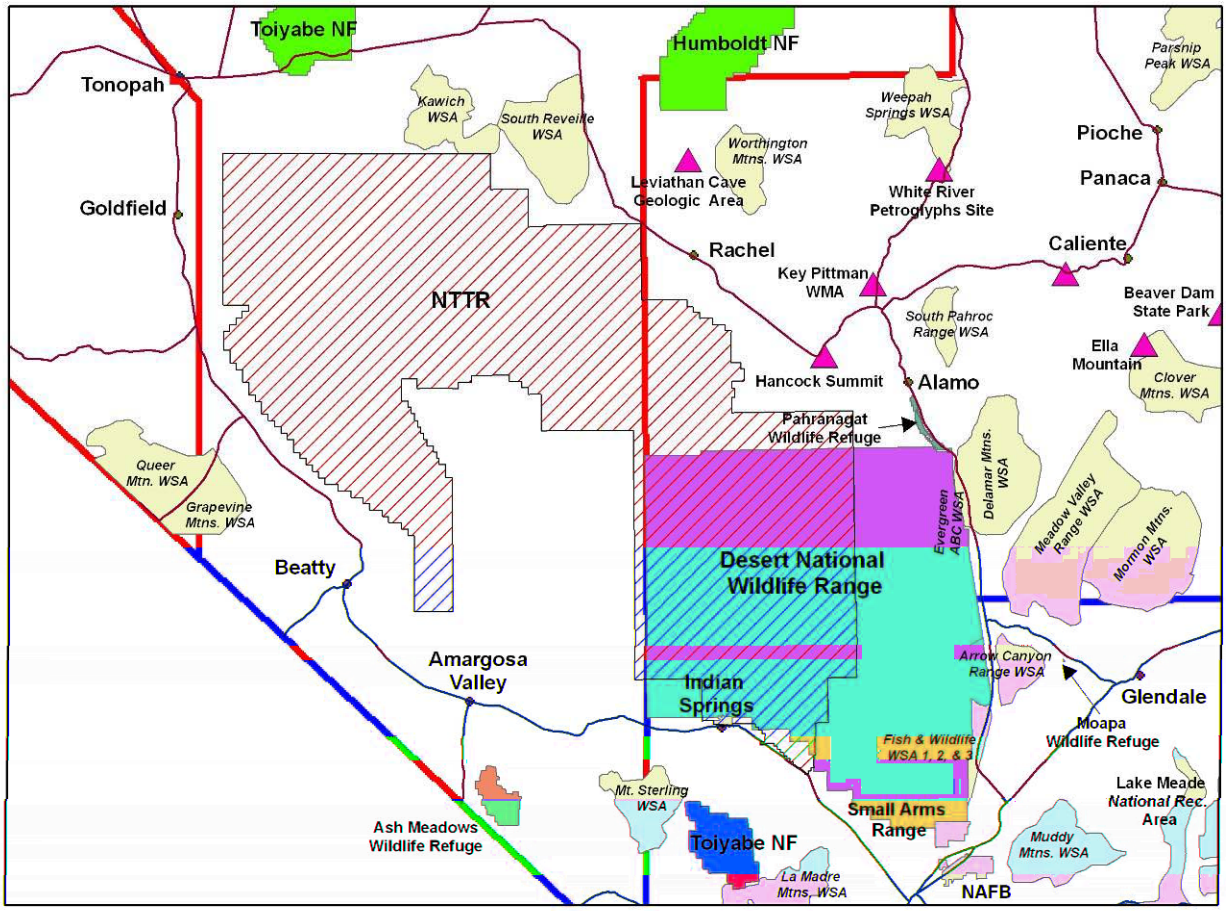
Several protected natural areas exist in the vicinity of NAFB and NTTR (Figure 2-5). The most prominent natural preserve in the vicinity is the DNWR, which is managed by the USFWS. Part of this facility is a jointly managed area of 826,000 acres within the boundaries of the South Range. The entire DNWR encompasses approximately 1,500,000 acres. That portion of the DNWR encompassing the Sheep Range, northern Las Vegas Range, and the North Desert Range, is managed by the DNWR as a Wilderness Study Area. Public access to the DNWR is through two roads originating at the USFWS Corn Creek Field Station approximately 23 miles north of Las Vegas, east of U.S. Highway 95. A primary mission of the DNWR is to manage and maintain habitat for desert bighorn sheep.

The DNWR is part of USFWS's Desert National Wildlife Refuge Complex (DNWRC). The DNWRC manages three additional preserves: the 5,500-acre Pahranagat National Wildlife Refuge (NWR); the 33-acre Moapa Valley NWR east of the NTTR in Lincoln and Clark counties; and the 13,000-acre Ash Meadows NWR in Nye County to the west (Figure 2-5). Together, the four refuges protect a broad range of native plant, invertebrate, and vertebrate species, some of which are endemic to this region alone. Lists of rare species protected by the DNWR are available from the USFWS.

In addition, the permanent lakes and marshes of the Pahranagat NWR are an important link in the Pacific flyway for birds migrating between their summer and winter habitats. The three smaller units of the DNWR provide unique aquatic and wetland habitats for plants and animals that are rare or non-existent on NAFB and NTTR. Several Wilderness Study Areas are also located near NTTR and NAFB and are shown in Figure 2-5. These areas are used to research various aspects of natural resources and their management.

To the west of the NTTR and U.S. Highway 95, within Clark and Nye counties, lies the Spring Range, administered by the Toiyabe National Forest, U.S. Forest Service (USFS). In August 1993 Congress directed USFS to develop a multiple use plan for this 316,000-acre area, to be known as the Spring Mountains National Recreation Area (SMNRA) (Figure 2-5). The SMNRA is adjacent to the Red Rock Canyon National Conservation Area, managed by the BLM, which is of approximately equal area. The highest peak in the northeastern Mojave Desert of Nevada, Mt. Charleston, is in the SMNRA. This 11,920 ft peak overlooks an important natural area with ponderosa pine forests and deep canyons that provides habitat for many plant and animal species. Some of the same vegetation can be found in the Sheep Range and on the NTTR at comparable elevations, but the Spring Range is typified by a greater number of higher elevation habitats where distinct vegetative communities are found. Adjacent to NAFB to the southeast lies the 1,500,000-acre Lake Mead National Recreation Area (NRA), administered by the U.S. National Park Service (NPS). As the nation's first Recreation Area, it is shared by Nevada and Arizona and includes two reservoirs on the Colorado River, the 100-mile long Lake Mead, and the 68-mile long Lake Mohave. A multitude of recreational opportunities not found on NAFB or NTTR, including swimming, boating, fishing, camping, picnicking, and wildlife viewing, are available in and along the lakes. Lake Mead NRA is also a stopover in the Pacific flyway for migrating birds (Figure 2-5). Finally, the Timber Mountain Caldera National Landmark is present on NTS near Range EC South.

Figure 2-5. Parks and natural areas located in the vicinity of NAFB and NTTR.



2.7 REFERENCES

Literature Cited

Carpenter, J. A., R. R. Elliot, and G. W. Sawyer. 1953. The History of Fifty Years of Mining at Tonopah, 1900-1950. University of Nevada Bulletin, vol. XLVII(1); Geology and Mining Series No. 51. Nevada Bureau of Mines.

Elliott, R. R. 1966. Nevada's Twentieth-Century Mining Boom: Tonopah, Goldfield, Ely. University of Nevada Press, Reno.

Fenneman, F. N. 1931. *Physiography of the Western United States.* McGraw-Hill, New York.

McMullen, R. E., A. L. York, P. deLespinasse, and W. G. Spaulding. 1995. Archaeological Survey of the Indian Springs Air Force Auxiliary Field, Nellis Air Force Base, Clark County, Nevada. Dames & Moore, Las Vegas, Nevada.

Nellis Air Force Base (NAFB). n.d. Environmental Assessment for Supersonic Flight over

the Nellis Range Complex. Las Vegas, Nevada.

_____. 1993a. Brief History of USAF Weapons and Tactics Center (Air Combat Command) and Nellis Air Force Base, Nevada. Nellis Air Force Base.

_____. 1993b. Assessment of the Subsonic Noise Environment in the Nellis Range Complex. Las Vegas, Nevada.

_____. 1996a. Draft Land Use Study. Las Vegas, Nevada.

_____. 1996b. Contamination Report for the Nellis Air Force Range Land Withdrawal Environmental Impact Statement. Las Vegas, Nevada.

_____. 1996c. *Final Current Conditions Report: RCRA Facility Assessment*. Las Vegas, Nevada.

_____. 1997a. Management Action Plan. Las Vegas, Nevada.

Noss, R. F., and A. Y. Cooperrider. 1994. *Saving Nature's Legacy: Protecting and Restoring Biodiversity.* Island Press, Washington, D.C.

Paher, S. W. 1971. Las Vegas: As it Began - As it Grew. Nevada Publications, Las Vegas.

Science Applications International Corporation, Inc. and Desert Research Institute (SAIC/DRI). 1989. Special Nevada Report - Evaluation of Cumulative Effects on the Environment and Population. SAIC, Las Vegas, Nevada.

Shearer, W. H. 1905. *Atlas of the Goldfield, Tonopah and Bullfrog Mining Districts of Nevada*. W. H. Shearer Publishing Co., Rand McNalley & Co., Chicago, Illinois.

Thompson and West. 1881. *History of Nevada, 1881*. Howell-North, Berkeley, California. Reprinted 1958.

Zanjani, S. 1988. *Jack Longstreet: Last of the Desert Frontiersmen.* University of Nevada Press, Reno.

Additional References

CH2MHill. 2003. Nellis Air Force Base Pipeline Project. Draft Environmental Assessment. Nellis Air Force Base, Nevada.

Department of the Air Force. 1999. Renewal of the Nellis Air Force Range Land Withdrawal Legislative Environmental Impact Statement. Nellis AFB, Nevada.

Nellis Air Force Base. 1997. Nellis Air Force Base and Range Bat Survey Report. Nellis Air Force Base, Nevada.

Nellis Air Force Base. 2002. Draft Environmental Baseline Study: Nellis Terrace Housing

Area. Nellis Air Force Base, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Water Wells Annex. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Manch Manor Housing Area. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Dunning Circle Housing Area. Nellis AFB, Nevada.

U.S. Army Corps of Engineers, Omaha District. 2001. Environmental Assessment: Live Ordnance Departure Area (LODA) at Nellis Air Force Base. Prepared for Environmental Management Office, Nellis AFB, Nevada.

United States Department of Defense Legacy Resource Management Program. 1997. An Inventory of 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, Part A: The Inventory.

United States Department of the Interior, Bureau of Land Management, Las Vegas District. 1992. Nellis Air Force Range Resource Plan and Record of Decision. Nellis Air Force Base, Nevada.

United States Air Force. 2002. Biological Assessment for Desert Tortoise Prepared for Section 7 Formal Consultation and Range-Wide Programmatic Biological Opinion. Nevada Test and Training Range, Air Combat Command. Nellis AFB, Nevada.

U.S. Army Corps of Engineers, Omaha District. 2001. Environmental Assessment: Live Ordnance Departure Area (LODA) at Nellis Air Force Base. Prepared for Environmental Management Office, 99 CES, Nellis AFB, Nevada.

THIS PAGE IS INTENTIONALLY LEFT BLANK

3.0 NATURAL RESOURCE DATABASE

Natural resource management planning and decision-making are based upon an analysis of the complex relationships of the current condition of natural resources, interrelationships among natural resources, and the effects of human actions upon natural resources. To reach effective decisions, natural resource planners, NAFB community planners, and NTTR planners need to have accurate information regarding the status of the resources, potential factors that may change that status, and the spatial relationship between the resource and those factors. Frequently this involves analyzing information from numerous maps, surveys, and databases. Manual interpretation of these data without the use of computer mapping and modeling may prove to be complex, time consuming, or impossible, thus limiting the scope of the analysis. GIS is a computer-based tool that allows integration and analysis of spatial resource data derived from fieldwork, maps and databases. The visual display and analytic power of the system enables natural resource managers to interpret the relationships among numerous factors affecting the resources they manage. A well-developed and maintained GIS also provides the resource manager with a long-term monitoring tool. With the development of new GIS software programs such as ArcView 9.1, resource managers can now easily learn to enter data into the databases and utilize GIS models to assist them in decision-making. Sensitivity models, alternative analyses models, and facility siting models can be efficiently and economically developed for use on a practical basis.

NAFB and NTTR are currently developing GIS databases that contain most of the infrastructure information for their respective areas. Most of the information on topographic features such as surface waters, elevation, and major features such as playa lakes is also included in the GIS. Additionally, the integration and linking of GIS spatial data with documentation and reports on the resources of various areas has not been initiated.

3.1 CURRENT STATUS OF GIS

At the present time, NAFB and NTTR have two relatively separate GIS programs working independently of each other. The NAFB database uses the State Plane NAD 1983 (Nevada East FIPS 2701) projection with feet as the map unit. This projection has excellent accuracy and less distortion for small areas such as the Base and is a good choice for Base use. NTTR uses UTM NAD 1983 (Zone 11N) with meters as the map unit. Again, this is a good choice for NTTR because of its size. State plane is not a good projection to use for large areas such as NTTR. Ideally, both NTTR and NAFB should be using the same projection, but with the advent of ArcGIS and ArcView 9.1, different projections are not a problem if each map layer has a well defined projection description included in their metadata file. These programs will convert GIS layers into the projection of the current map as the files are incorporated into a map. In the sections that follow, the current status of GIS at NAFB and NTTR will be discussed.

3.1.1 NAFB

Currently, 99th CES has developed a comprehensive GIS database containing excellent, up-to-date information on the infrastructure of NAFB. The database has been reviewed and checked for a level of accuracy that is required for NAFB operation and planning. NAFB currently uses ArcGIS 8.3 for database development and will be upgrading to 9.1 in the near

future. The ArcView software is fully compatible with ArcView 3.2, the GIS software currently used by NTTR. ArcView 8.3 is used by NTTR as required. ArcView also links into commonly used desktop database and spreadsheet software such as Microsoft Excel and Access programs, allowing NAFB managers direct interface with existing data sets to address management issues on NAFB and NTTR. The NAFB GIS staff is currently developing a geospacial database that will incorporate much of the data collected by the natural resources program and place it on the Base intranet allowing it to be available for use by military and civilian staff at NAFB and NTTR. The database also has developed GIS protocols for all types of data collected ranging from facility infrastructure data to natural resources data.

Some of the major coverages currently in the NAFB geospatial database include the following:

- Rare plant survey data from NAFB
- Desert tortoise survey data
- Invasive plant data
- Noise contour data from past and recent studies conducted on NAFB
- Political boundaries in the vicinity of NAFB (city limits, county boundaries, ranges, sections, etc.)
- Boundaries of NAFB and Indian Springs
- Locations and shapes of all buildings on NAFB
- Surface waters
- Fence lines
- Recreational areas
- Elevation contours (2 ft. contours) for NAFB and Indian Springs
- Information on military operations such as flight tracks and firing range areas
- Air accident zones
- Airfield areas and boundaries
- Pedestrian sidewalks
- Railroads
- Roads and parking areas
- Electrical lines, transformers, substations, etc.
- Stormwater lines
- Water and wastewater lines and facilities
- Wells
- IRPs
- Color aerial photographs

These coverages include NAFB and Indian Springs. As previously mentioned, this GIS database is placed in the State Plane NAD 1983 projection with feet as the measuring unit. The data is supported by ArcGIS 9.1, with 99th CES design input provided in CAD Version 14.0.

Major data gaps include comprehensive information on natural resources. Natural resources data currently in the database are incomplete and do not include information on soils, geology, large and small mammals, reptiles, amphibians, migratory birds, pests, species of concern, and vegetation communities. These gaps in information can lead to unnecessary delays in the implementation of various mission projects across the Base due to longer time spent on federal agency coordination and lack of identification of problem areas.

A complete, comprehensive GIS database will allow planners to have critical information at their fingertips for developing Base plans and operations that avoid or at least minimize impacts to the environmental, streamlining NEPA compliance and permit acquisition.

3.1.2 NTTR 98th Range Wing

98th RANW maintains a fully operational GIS database for the primary use of mission operations planning and configuration management (layout of threats and targets). At NTTR, the GIS is typically used in support of the primary mission of pilot training. The most common applications involve mission planning where proposed targets and threats are mapped for use during training exercises. In addition, GIS is used for the long-term planning of infrastructure development and future land use.

The 98th RANW GIS lab is set up as a centralized computing center, with GIS terminals outside of the lab in the offices of CE. Two full-time GIS technicians support the range GIS database with CAD support from NTTR civil engineering. A Local Area Network (LAN) links the various workstations and PCs and connects all PCs to the Internet.

Some of the coverages currently in the NTTR database include the following:

- Boundaries of NTTR, air space, and other jurisdictional areas
- Roads
- Target areas
- Landing strips
- Buildings/facilities
- Contours
- USGS 7.5 minute quads
- Limited aerial photographs
- Wells
- Mines
- Springs and surface waters
- Playa lakes
- IRPs
- Desert Tortoise Survey Data (1991)
- Hydrographic basins
- Noise zones
- Flight zones
- Limited coverages on plant communities
- Threat areas

3.2 NEEDS ASSESSMENT AND RECOMMENDATIONS FOR GIS

3.2.1 Infrastructure

3.2.1.1 Issues or Problems

Infrastructure data includes those data sets that are more appropriate for an urban environment. Their scale and resolution and the analysis performed upon them would likely be at a much finer scale than those used for natural resource information. Some GIS data types

might include, but are not limited to, building footprints, streets, infrastructure locations, parks/open land, recreational trails, and landfills.

At the time of this report, the GIS database contained excellent, up-to-date information on the infrastructure of NAFB and NTTR. Current designs and changes are being incorporated into the databases. Most of the data is supported with metadata sets that are of sufficient quality to allow for accurate conversion into different projections.

3.2.1.2 Recommendations

Data sets that are created for infrastructure must meet the Tri-Service standard for data accuracy. A careful plan of Quality Assessment/Quality Control (QA/QC) must be implemented to ensure integrity of these data sets. This will provide natural resource managers with a level of confidence and defensibility for any analysis based upon the GIS data. Consistent quality checks, documentation, and metadata creation should be established during the data compilation period and prior to data input.

Attentiveness to the precision and accuracy of infrastructure data should be continued. A high level of precision is important for proper engineering decisions to be made and conducting the daily operations of NAFB and NTTR. 99th CES, 98th RANW, and 99CES/CEVN should continue to cooperate and coordinate on GIS programs to allow for proper management of natural resources.

3.2.2 Natural Resources

3.2.2.1 Issues or Problems

The major issues or problems centered on GIS at NAFB and NTTR include the following:

- Insufficient GIS data to allow for use as a natural resource management tool and range management tool
- NTTR and NAFB use two different versions of ArcView for database development and analyses
- Some shape files do not contain projection information in their metadata
- NTTR and NAFB use two different projections for their databases

Currently, only minimal effort has been made to develop a natural resource database. This has been mostly due to the fact that most of the GIS efforts are being focused on development and upgrading of the infrastructure and operations database. This is justified because it is extremely critical to the mission of NAFB and NTTR. Because a limited number of GIS trained personnel are available, the natural resource component of GIS has not been sufficiently addressed to provide information useful to resource managers. Historic and current coverages on natural resources must be incorporated into the database to provide a database that is useful for resource management.

NTTR currently uses ArcView 3.2 for GIS, while NAFB uses ArcView 9.1. This means that models developed by either group are not compatible. Shape files and coverages can be used with both programs, but actual viewing of the data and development of models cannot be easily transferred between the versions. ArcView 3.2 cannot import models or maps created by ArcView 9.1. In contrast, ArcView 9.1 can import maps from ArcView 3.2, but the maps usually require some level of effort to ensure that they are consistent with the appear-

ance of the original map. Additionally, ArcView 9.1 cannot import models and other more complicated procedures from ArcView 3.2 without a great deal of manipulation and effort.

As previously discussed, NTTR and NAFB are currently using different geographic projections for their databases. NTTR uses the UTM NAD 83 projection because this is a more appropriate project for large areas such as NTTR. However, NAFB uses the State Plane NAD 1983 projection because it is actually more accurate for the design work for smaller areas such as NAFB. Unfortunately, resource managers often need data from both NAFB and NTTR for their work. ArcView 9.1 easily accommodates conversion of files from different projections if the shape files and other coverages are accompanied with metadata files containing projection information.

3.2.2.2 Recommendations

The natural resource database should focus on data relating to the environment with inclusion of the human environment, as appropriate in an ecosystem management context. The scale of analysis and data capture for natural resources would typically be much coarser than those used for infrastructure and design. However, certain natural resources may require finer map detail than others. It is important that the accuracy of the map closely correlate to the accuracy of the field measurement. For example, archaeological features have relatively discrete locations and boundaries, thus requiring a high level of accuracy for mapping. In contrast, plant community boundaries are not discrete and usually have transition zones that make field delineation accurate within 10 to 20 ft.

Ideally, the natural resource database and programming should be handled as one unified database under NTTR and NAFB. The natural resource manager would develop standard data collection protocols and ensure that the collected data is compatible with the standard database formats. Initially, data should be brought to the natural resource manager for review to ensure that it is compatible with natural resource data requirements and meets the protocols set by the NAFB Geodatabase. Once the data is verified and approved by the natural resource manager, it can be transferred to NAFB and NTTR to be incorporated into their GIS for final archiving. Currently, the GIS program at NAFB is developing data collection protocols for use of the Trimble Geoexplorer XT units for all data collection at NAFB and NTTR. These protocols will be incorporated into the natural resources survey work when available. In the future, data collection protocol included in contracts will require outside consultants to use the same equipment for their data collection.

It is recommended that ArcView 9.1 be used for the development of the natural resource database. NTTR personnel can continue to use ArcView 3.2 for infrastructure and other database, and can continue to provide resource managers with shape files for use in the resource management database. ArcView 3.2 shape files are fully compatible with ArcView 9.1 shape files. Conversely, ArcView 9.1 shape files can be used by the NTTR database.

Typical natural resource datasets might include, but are not limited to, vegetation cover, wetlands, wildlife breeding and feeding locations, and existing disturbances. Some of these data are currently being developed by private consultants, TNC, the Great Basin Bird Observatory, and the Gap Analysis Program (GAP). Additional data on big game are available from BLM, NDOW, USFWS and the Clark County Multiple Species Habitat Conservation Plan (MSHCP). Surveys have been conducted at NTTR for bats (NAFB, 1997d), birds (NAFB, 1997e), and wetlands (NAFB, 1997b). Extensive GIS data is also available for

vegetation analyses and other studies on the northern range area and portions of the southern range (Bechtel, various dates). This data is may be available in GIS format, but further research and cooperation with the owners of the data is necessary to obtain the data. These data sets cover sensitive natural resource management areas and will be a part of the INRMP analyses if they can be obtained. Vegetation mapping for NTTR has been addressed initially by TNC through their survey for rare plants, which includes establishment of standardized sampling plots and generalized descriptions of vegetation communities. Additional plots could be added to the program or existing plots modified so as to include potential ecotone areas. The results of the sampling plots can be utilized as a ground truthing exercise on which to build a more comprehensive NTTR vegetation map using aerial photographs. The GAP, sponsored by the National Biological Survey, can also be used to supplement the initial data for NTTR. The acquisition of rectified aerial photography combined with ground truth plots would be the single most complete and rapid method for mapping the vegetation of NTTR.

Problems inherent in the compilation of a multi-source GIS are data quality control, uniformity of data attributes, and the ability to track the source of the data. For integration of multi-source GIS data, it is critical that data documentation, or metadata, is compiled. At a minimum, metadata should contain the following:

- full description of the data's projection and scale of resolution;
- description of all related attribute data features, i.e. a data dictionary;
- source of the data; and
- contact name and number for troubleshooting, if available.

Other useful information could include the following:

- QA/QC tolerances/testing;
- Data precision and accuracy if a GPS was used;
- data security/confidentiality status;
- description of any assumptions made for the data; and
- descriptions of planned data updates or modifications.

Currently, there are several GIS data sets that could be useful for resource management of NAFB and NTTR (Table 3-1). Once a GIS has been developed for natural resource management, it will require updating as new resource data become available. The mechanisms and responsibility for updates and maintenance will require coordination between NAFB and NTTR to ensure the long-term integrity and utility of this information. NAFB GIS staff is currently developing a geobase that will assist in accommodating updates and new data acquisition. Additionally, 99th CES/CEVN is developing a GIS database to be used for natural resources staff for data collection, archiving, and model building.

TABLE 3-1
Currently Available GIS Data at NAFB and NTTR

DATA NAME	DATA TYPE	SCALE/ RESOLUTION	SOURCE	COMPILER	STATUS
Wetlands Survey	Point locations of surface waters.	Variable: recorded with GPS.	GPS field survey	Dames & Moore	Partially complete

DATA NAME	DATA TYPE	SCALE/ RESOLUTION	SOURCE	COMPILER	STATUS
Surface Waters	Line	1:24,000	NAFB and 98th RANW	NAFB and 98th RANW	Partially complete
Bird Survey	Point location of raptor observations; general assessment of use of Range by other birds.	Variable: recorded with GPS.	GPS field survey	Dames & Moore	Partially complete, but not comprehensive
Bat Survey	Point location of bat observations	Variable: recorded with GPS.	GPS field survey	Dames & Moore	Partially complete, but not comprehensive
Wildlife Distributions	General distribution areas	Variable	NDOW, USFWS, BLM	NDOW, USFWS, BLM	To be requested
Boundaries	Lines of administrative boundaries	1:250,000	DMA Nellis AFR map.	Dames & Moore; Baker	Completed
Archeological Features	Points and Boundaries	Unknown	99th CES	99th CES	In Progress
Elevation Contours	Lines of elevation	Intervals from 2 ft to 100 ft	Derived from DEM	98th RANW GIS	Completed for 100 ft. contours
Catchments	Shape files	Unknown	98th RANW	98th RANW GIS	60s Ranges only
Roads	CAD and shape files	1:24,000	USGS/ Lockheed Survey	98th RANW GIS	Completed
Air Fields	AutoCAD line drawings	Unknown	Unknown	98th RANW GIS	Completed
Landfills	CAD	Unknown	Unknown	98th RANW GIS	Unknown
Aerial Photography	jpg, tif, sid	Variable (0.5 ft to 30 ft)	98th RANW 99th CES	98th RANW 99th CES	1999 only needs to be updated and rectified. NAFB complete.

Note: 98th RANW GIS holds an extensive GIS database that details many Range related issues. However, their listings are too vast to be included in this table. Most of their collection is concerned with mission operations and therefore includes limited environmental data. As necessary data is identified for INRMP use, 98th RANW GIS should be queried as a possible data source.

The following map layers for NTTR have been identified as complete or nearly complete and need to be incorporated into the natural resource database:

- Infrastructure including utilities, fences, roads, buildings, facilities, and target areas
- Archeological features (currently being updated)

Gaps in the current natural resource database have been identified and will be discussed in more detail in the management section of the INRMP, but are listed in Table 3-2.

TABLE 3-2
Data Gaps Identified for the INRMP

DATA TYPE	IMPORTANCE TO MISSION ACTIVITIES	DATA COLLECTION STRATEGY
Wetlands	Prevents delays due to USACE permit requirements.	Wetlands survey using historic data and helicopter surveys.
Surface Waters of the U.S. including Ephemeral Streams and Alluvial Fans	Prevents delays due to USACE permit requirements.	Surface waters surveys using topographic maps, aerial photography, and ground surveys.
Geologic Formations	Assists in the location of specific features needed for mission activities. Identify potential habitat for species of concern preventing delays caused by endangered species issues.	Incorporate historic data from state geologic maps and conduct ground truth studies in association with other field work.
Soils	Identify potential habitat for species of concern preventing delays caused by endangered species issues.	Utilize soils survey data being collected by the BLM on the North Range. Use STASGO data and then ground surveys on the South Range.
Vegetation Communities and Riparian Corridors	Assists in the location of specific vegetation attributes needed for specific mission activities. Identify potential habitat for species of concern preventing delays caused by endangered species issues.	Use aerial photography to prepare initial maps. Later ground truth mapping beginning with the areas of highest use by NTTR and NAFB.
Sage Grouse Habitat	Potential delay to mission activities due to endangered species issues if the species is listed.	Use BLM delineation initially and then conduct helicopter surveys to find strutting grounds and potential habitat.
Pygmy Rabbit Habitat	Potential delay to mission activities due to endangered species issues if the species is listed.	Habitat is similar to sage grouse and surveys for both species could be combined.
Desert Tortoise Habitat	Potential delay to mission activities due to endangered species issues. Development of Desert Tortoise Management Plan could streamline consultation with the USFWS.	Helicopter surveys to identify general boundaries of habitat and then use ground truth surveys to fine tune data.

DATA TYPE	IMPORTANCE TO MISSION ACTIVITIES	DATA COLLECTION STRATEGY
Wildlife Species of Concern	Potential delay to mission activities due to endangered species issues if the species is listed. Also, provides information and support for NDOW.	Use vegetation and soils data to identify potential sites and then use field surveys to confirm findings.
Rare Plants	Potential delay to mission activities due to endangered species issues if the species is listed. Also, provides information and support for NDOW and the Nevada Natural Heritage Program.	TNC inventoried the rare plants on NTTR in 1996-1997. This data was recently incorporated into the Natural Resources Database and will be used in combination with soils and other physical data to monitor identified populations of rare plants and locate new populations of rare plants.
Antelope	Protect game species as required by state law. Prevent fines and delays associated with infractions to those laws.	Use annual helicopter surveys to locate antelope populations and numbers.
Mule Deer	Protect game species as required by state law. Prevent fines and delays associated with infractions to those laws.	Use annual helicopter surveys to locate mule deer populations and numbers.
Desert Bighorn Sheep	Protect game species as required by state law. Prevent fines and delays associated with infractions to those laws.	Use annual helicopter surveys to locate bighorn sheep populations and numbers.
Wild Horses	Protect the species as required by federal law.	Incorporate BLM data into the GIS. Add any location data provided by natural resources personnel during other surveys.
Reptiles	Assist state and federal agencies in determining the distribution of reptiles in southern Nevada. May prevent the listing of species which causes delays to the mission.	Ground surveys in combination with topography, vegetation and soils mapping.
Small Mammals	Assist state and federal agencies in determining the distribution of small mammals in southern Nevada. May prevent the listing of species which causes delays to the mission.	Live trapping studies in combination with topography, vegetation and soils mapping.
Bats	Assist state and federal agencies in determining the distribution of bats in southern Nevada. May prevent the listing of species which causes delays to the mission. Bats can be a BASH issue for low flying aircraft.	Live trapping studies near potential habitat such as caves, mine shafts, and seeps/springs.

DATA TYPE	IMPORTANCE TO MISSION ACTIVITIES	DATA COLLECTION STRATEGY
Migratory Birds	Fill in the gaps of data on raptors and migratory birds currently existing in Nevada. Prevent unnecessary impacts to migratory birds as required by the Migratory Bird Treaty Act. Play an important role in the Partners in Flight program.	Surveys during the spring and fall migrations. Use surveys from outside of the range to determine the location of potential flight paths.
Burrowing Owl Data	Potential delay to mission activities due to endangered species issues if the species is listed.	Identify and locate burrows and habitat during any other natural resources surveys.
Hunting Data	Assist in the location and characteristics of bighorn sheep on the South Range.	Incorporate data collected by USFWS and NDOW for winter bighorn sheep hunts.
Slopes and Aspects	Use to identify potential habitat for species of concern and rare plants.	Use topographic data to model slopes and aspects.

These data gaps should be filled in a reasonable time period to provide NTTR and NAFB with a database that can be useful for short and long term planning as well as daily maintenance and operations.

One of the key tools for natural resource management is aerial photographs. NAFB has excellent aerial photographs that are re-taken on an annual or bi-annual basis. On NTTR, mission constraints and security issues often make aerial photography difficult, but with proper planning aerial photography can be accommodated for most areas on NTTR. For resource management on such a large area, true color aerial photographs taken in the spring when plants are green and often in bloom are preferable. With these photographs, the status of natural resources can be easily monitored and vegetation/habitat can be mapped using some ground truth data. Changes in plant communities and areas of disturbance can be easily detected by manual comparison or image analyses of aerials taken at different times. Recently, 99th CES suggested to the USFWS that NTTR use aerial photographs to map vegetation communities and soils to delineate potential tortoise habitat. This information could then be used to reduce the need for 100% ground surveys in areas previously determined to not contain habitat. The cost savings associated minimizing the need for 100% surveys with good aerial photo analyses would be significant.

Data currently in the natural resource database should be combined from both NAFB and NTTR to develop a uniform GIS and clearance house linked together for easy access and use. The resource management issues are the same for both locations and should be maintained in the same database. The database could then be provided to NAFB Geobase and 98th RANW in a format that is compatible with their databases. Incomplete coverages could be updated and completed. New layers of natural resources data could also be created using past reports and new surveys.

Data placed in the natural resource database should be linked to supporting documents in PDF format. For example, if a resource manager is using GIS to study desert tortoise data, he should be able to point and click on the study area and be immediately linked to the study supporting the data. That document would then open and be available for the man-

ager to read. Trips to the Base library or other information sources would no longer be necessary when the database is completed.

Even more important, GIS modeling could be used to develop sensitivity maps to illustrate the areas where natural resource sensitivity is highest and costs relative to mitigation and required surveys are extensive. Thus, NTTR and NAFB planners could easily obtain this information and attempt to avoid or minimize impacts to sensitive areas when planning new facilities, roads, target areas, etc. Additionally, NAFB, NTTR, NDOW, USFWS, BLM, and other agencies could work together to develop regional databases for conservation and management of natural resources.

3.2.2.3 Actions Taken to Develop and Improve the NR Database

The following are planned actions for development and improvement of the natural resource database:

- Assess the need for system upgrades/replacements. Most standard computers with a 512 to 1024 MB RAM and a standard speed processor can be used for GIS. ArcGIS 9.1 will be required for each computer. If modeling is to be used, the ArcView Spatial Analyst extension will also be required. At a minimum, resource managers and planners should be equipped with these tools.
- Complete development of the following coverages in order of priority:
    - Elevation contours (10 to 50 ft. contours if available)
    - Infrastructure including utilities, fences, roads, buildings, facilities, and target areas
    - Playas
    - Wetlands
    - Streams and other surface waters
    - Archeological features
- Develop the following layers for the natural resource database (in order of priority):
    - Aerial photographs (3 ft resolution)
    - Desert tortoise habitat
    - Rare plants (Past data and updated data)
    - Burrowing owl data
    - Other endangered or threatened species (State and federal lists)
    - Slopes and aspects (from elevation data)
    - Ephemeral streams, drainageways, and alluvial fans
    - North Range riparian plant communities
    - Geologic formations
    - Soils
    - Vegetation communities
    - Sage grouse habitat
    - Pygmy rabbit
    - Reptiles
    - Small mammals
    - Wild horses
    - Antelope
    - Mule deer
    - Desert bighorn sheep
    - Bird survey data

  - Bat survey data
  - Hunting data
  - Weather data
  - Wildlife – carnivores
  - Wildlife species of concern
  - Small mammals
  - Wild horses
- Currently coordinating with state and federal agencies to obtain information that has been collected recently and in the past for NTTR and NAFB.
- Develop models and maps that can be used on a practical basis by all resource managers and NTTR/NAFB planners.
- Customize ArcView to make the program more user-friendly and tailored to the needs of the users.
- Initiate a training program for all resource managers and NTTR/NAFB planners to allow them to properly update the database and use models/maps as necessary.

3.3 TRAINING PROGRAMS FOR GIS

To effectively utilize the natural resource database, 99th CES will need to train its resource managers and base planners on the use of ArcView 9.1. Training courses are available directly through Environmental Systems Research Institute, Inc. (ESRI) web page, or from ESRI licensed ArcView instructors. A standardized Introduction to ArcView course provides the foundation for becoming a skilled ArcView user. The typical two-day course provides the hands-on experience and conceptual overview of the advanced display, analysis, and mapping functions of the ArcView package. No previous knowledge of desktop mapping or GIS technology is necessary.

Another option is to train personnel using contractors or NAFB personnel who are familiar with the system on-base and can teach the use of the models and maps directly. The advantage of this approach is that the users are taught the skills they need to know using the database and models that they will actually be using. Training can be personal, with the trainer teaching each person on their own computer or in a group setting where several students can be taught in a training room.

With well-trained personnel and a current, operational natural resource database, natural resource management at NAFB and NTTR will be streamlined and highly useful for managers and planners alike.

3.4 REFERENCES

Literature Cited

Nellis Air Force Base. 1997b. Wetland Survey Report. Air Force Project No. RKXF956044. Las Vegas, Nevada.

Nellis Air Force Base. 1997d. Bat Survey Report. Air Force Project No. RKXF956140. Las Vegas, Nevada.

Nellis Air Force Base. 1997e. Bird Survey Report. Air Force Project No. RKXF956145. Las Vegas, Nevada.

Additional References

CH2MHill. 2003. Nellis Air Force Base Pipeline Project. Draft Environmental Assessment. Nellis Air Force Base, Nevada.

THIS PAGE IS INTENTIONALLY LEFT BLANK

4.0 NATURAL RESOURCES AND THEIR MANAGEMENT

Proper management of natural resources requires a broad-based knowledge of flora and fauna and their interaction with the physical environment. The natural resource database will provide the Nellis community with the information required to make well-founded decisions with respect to NAFB and NTTR planning. Also, comprehensive data on natural resources reduces the time and need for consultation with federal agencies and assists the mission in locating suitable sites for training.

This section of the INRMP will familiarize the reader with the major natural resources on NTTR and NAFB. Review of past studies and use of maps in this INRMP will be restricted to referencing the available reports and data available on the natural resource database. This section will be devoted to discussion of management issues and guidelines for natural resources at NAFB and NTTR. Unless necessary, no differentiation will be made between NAFB and NTTR within the context of resource management, since the guidelines are generally the same for both.

4.1 CLIMATE AND GENERAL ECOLOGICAL SETTING

NAFB and NTTR lie between 36°15' N lat. and 37°53' N lat. in interior western North America. With the Sierra Nevada Range approximately 90 miles to the west and the Wasatch Range 135 miles to the east, the majority of NTTR lies within the hydrographic Great Basin (Morrison, 1965; Section 6.2), while NAFB lies within the Colorado River drainage. Separated from the moderating influence of the Pacific Ocean by hundreds of miles and by the lofty Sierra Nevada, NTTR and NAFB are dominated by a continental climate with pronounced winter and summer seasons and low rainfall.

4.1.1 NAFB

NAFB is located in the Mojave Desert, which has a climate characterized by mild winters and hot summers. The Mojave Desert, although not generally as cold as the Great Basin Desert to the north, receives several nights of frost each year. Typically, these very cool nights occur when cold Great Basin air from the north settles over the desert on still nights. In August, however, the temperatures may exceed 110°F by day and not drop below 90°F at night. Mean monthly temperatures range from a low of 45°F in January to a high of 91°F in July, as recorded at McCarran International Airport (Ashby, 1996). Mean annual rainfall at this elevation is approximately 4 inches. Annual temperature and precipitation maps are presented in Figures 4-1 to 4-3.

4.1.2 NTTR

The elevation and latitude differences between the South and North Ranges result in marked temperature and precipitation differences between the two (El-Ghonemy et al., 1980). A mean annual temperature of 63ºF, as recorded at the Desert Game Range weather station at the Corn Creek Field Station (Ashby, 1996; Table 4-2), is generally representative of South Range valleys. In contrast, the North Range has a mean annual temperature of 51ºF annually, extrapolated from the Goldfield weather station near Range 71 (Table 4-3). In the last 48 years, the daily mean temperature in the North Range for January fell below freezing 20 out of 38 months

recorded, whereas the South Range never had a daily mean temperature below freezing in January.

Precipitation is limited throughout NTTR. Near the North Range, Goldfield has a mean annual precipitation of 6.5 in, whereas near the South Range, the mean annual precipitation is 4.3 in (Ashby, 1996). Though slightly more rain falls in the North Range than in the South Range, and the mountain tops receive significantly more precipitation than the valley floors, the entire area lies within some of the most arid terrain in North America. Regular, strong winds, combined with low relative humidity, yield an annual evaporation rate that exceeds precipitation by as much as 10 times. The lack of rainfall and vast undeveloped acreage contribute to making NTTR ideal for military ground and air exercises and training.

TABLE 4-1

Temperature and Precipitation Data Recorded at Las Vegas McCarran International Airport, Nevada, 1937-2005

Month	Mean Temperature (ºF)		Precipitation (in)
	Daily Max.	Daily Min.	Monthly Mean
January	57.0	34.3	0.52
February	62.5	38.7	0.60
March	69.4	44.1	0.47
April	78.1	51.5	0.22
May	88.3	60.7	0.16
June	98.5	69.5	0.07
July	104.5	76.1	0.45
August	102.1	74.5	0.45
September	94.7	66.2	0.33
October	81.4	54.1	0.25
November	66.3	41.6	0.37
December	57.4	34.5	0.40

Source: Western Regional Climate Center, http://www.wrcc.dri.edu

TABLE 4-2

Temperature and Precipitation Data Recorded at Desert Game Range, NV, 1948-2005

Month	Mean Temperature (ºF)		Precipitation (in)
	Daily Max.	Daily Min.	Monthly Mean
January	57.2	29.3	0.48
February	61.8	32.7	0.60
March	68.3	37.6	0.56
April	76.6	44.2	0.30

Month	Mean Temperature (ºF)		Precipitation (in)
	Daily Max.	Daily Min.	Monthly Mean
May	86.0	52.1	0.19
June	96.3	60.1	0.13
July	101.9	67.0	0.38
August	99.7	65.5	0.43
September	92.4	57.7	0.38
October	80.1	46.9	0.33
November	66.0	36.1	0.35
December	57.3	29.4	0.38

Source: Western Regional Climate Center, http://www.wrcc.dri.edu

TABLE 4-3
Temperature and Precipitation Data Recorded at Goldfield, Nevada, 1948-2005

Month	Mean Temperature (ºF)		Precipitation (in)
	Daily Max.	Daily Min.	Monthly Mean
January	42.5	21.4	0.62
February	47.2	25.6	0.86
March	53.6	29.8	0.66
April	61.8	35.4	0.58
May	70.8	43.6	0.58
June	80.8	51.8	0.43
July	89.0	59.7	0.49
August	86.58	57.9	0.53
September	78.7	50.0	0.54
October	66.7	39.6	0.42
November	52.7	29.1	0.41
December	43.3	21.7	0.31

Source: Western Regional Climate Center, http://www.wrcc.dri.edu

Figure 4-1. Average annual precipitation in the area surrounding NAFB and NTTR.

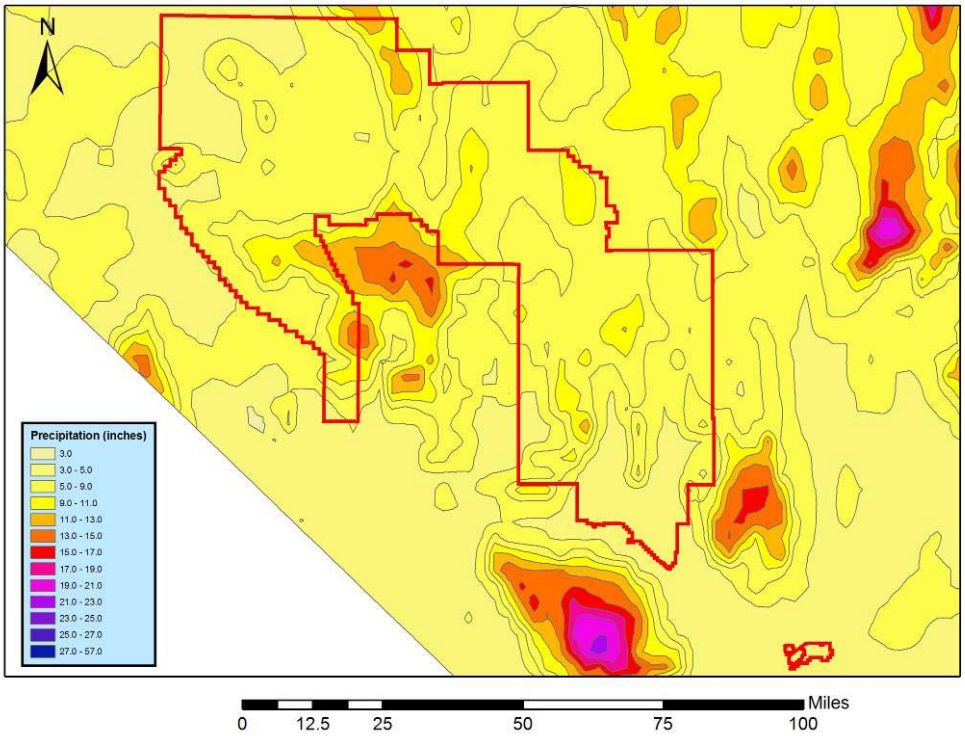


Figure 4-2. Average daily low temperature each year across NAFB and NTTR.

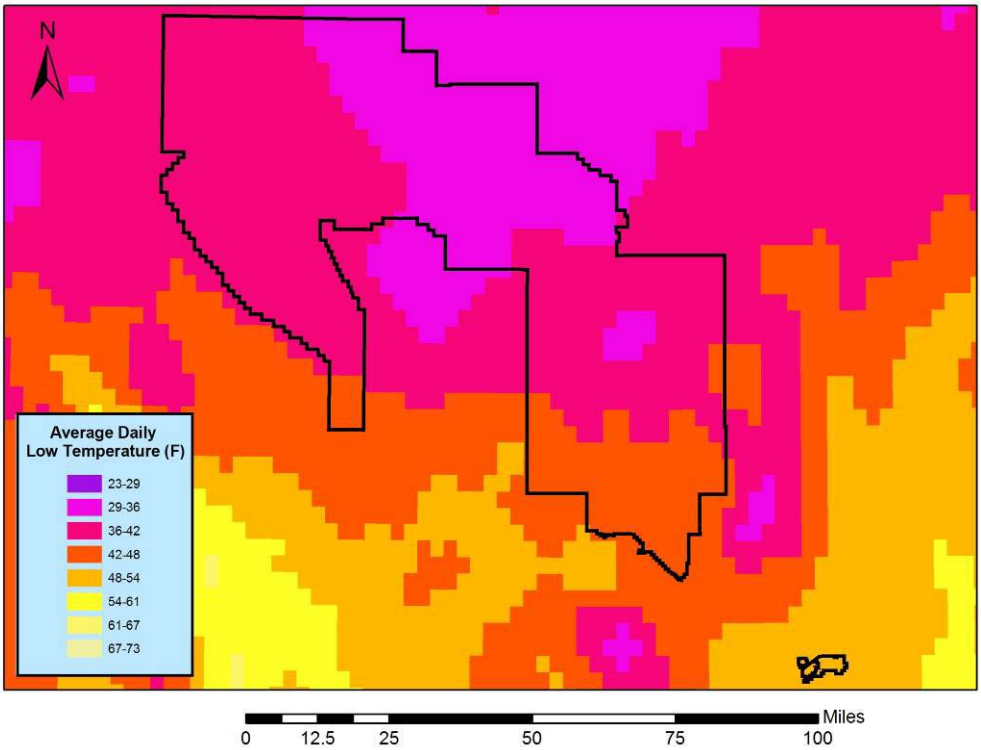
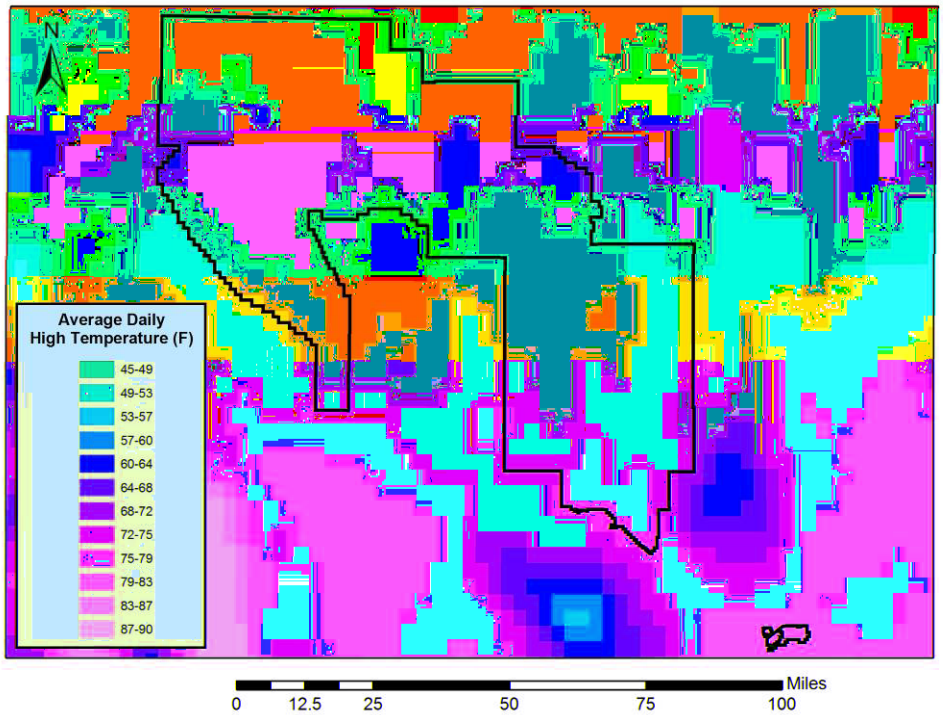


Figure 4-3. Average daily high temperature each year across NAFB and NTTR.



4.1.3 References

Literature Cited

Ashby, J. 1996. Temperature and precipitation records for Las Vegas, Corn Creek, and Goldfield Stations. Desert Research Institute, Western Climatology Center, Reno, Nevada.

El-Ghonemy, A. A., A. Wallace, and E. M. Romney. 1980. "Socioecological and soil-plant studies of the natural vegetation in the northern Mojave Desert-Great Basin Desert interface." *Great Basin Naturalist Memoirs* 4.

Morrison, R. B. 1965. "Quaternary Geology of the Great Basin." *The Quaternary of the United States*, edited by H. E. Wright, Jr. and D. G. Frey, pp. 265-286. Princeton University Press, Princeton, New Jersey.

Additional References

Nellis Air Force Base. 1997. Nellis Air Force Base and Range Bat Survey Report. Nellis Air Force Base, Nevada.

United States Department of Defense Legacy Resource Management Program. 1997. An Inventory of 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, Part A: The Inventory.

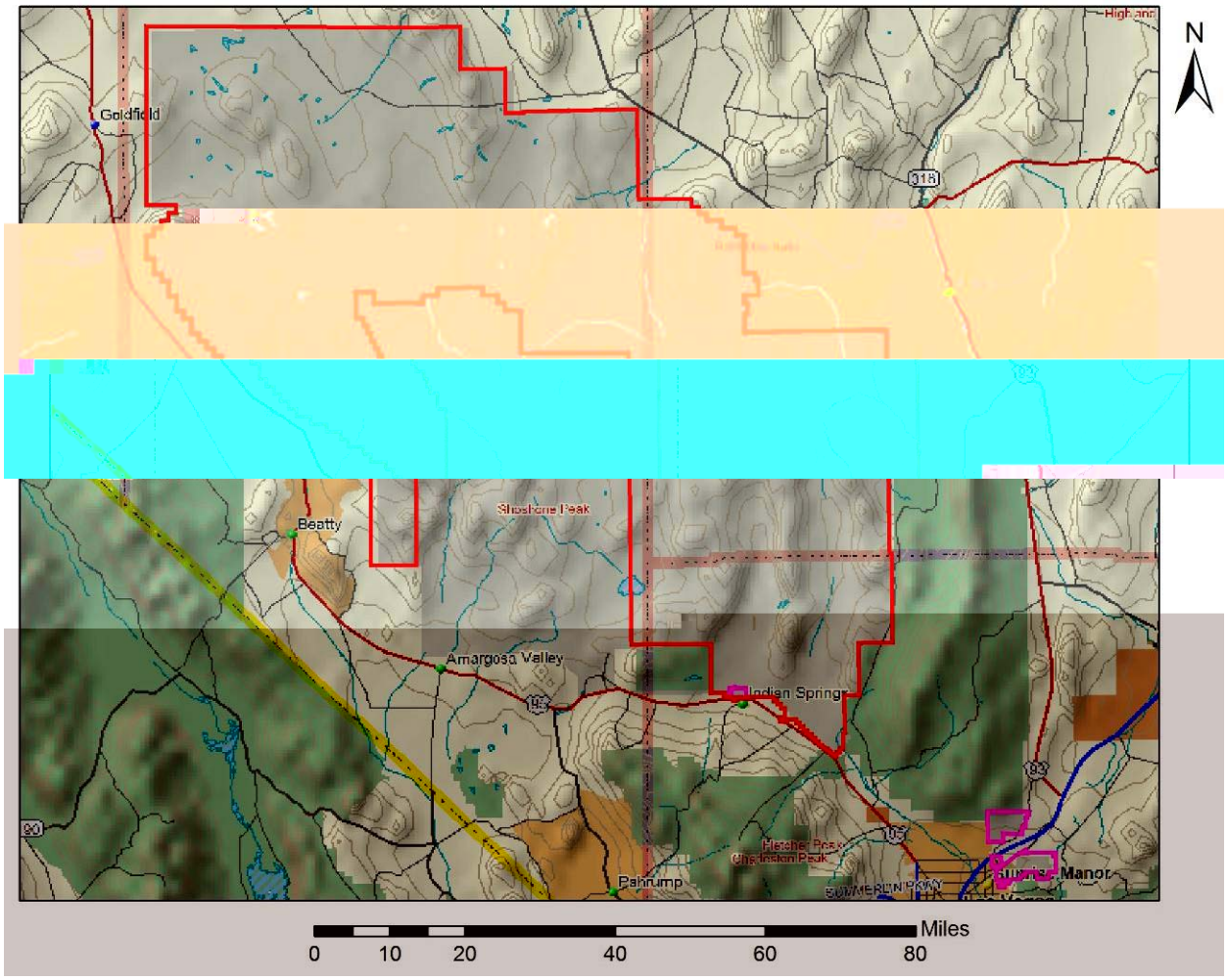
U.S. Army Corps of Engineers, Omaha District. 2001. Environmental Assessment: Live Ordnance Departure Area (LODA) at Nellis Air Force Base. Prepared for Environmental Management Office, 99 CES, Nellis AFB, Nevada.

4.2 TOPOGRAPHY

4.2.1 Description of Current Conditions

NTTR and NAFB lie in the Basin and Range physiographic region consisting of a series of north-south trending mountain ranges and intervening basins that extend from southeast Oregon into Mexico (Fenneman, 1931). Individual mountain ranges rise out of both the Mojave and Great Basin Deserts, and their tendency to be aligned along similar axes provides some degree of connectivity to the high-elevation habitats of the two deserts, particularly for bird species. The basins between the mountains increase in elevation from south to north such that elevation as well as latitude contributes to the decline in thermal regimes to the north and the consequent vegetation change along the basins.

Figure 4-4. General topographic map of NTTR and NAFB.
(Source: DeLorme Topo USA Version 3.0)



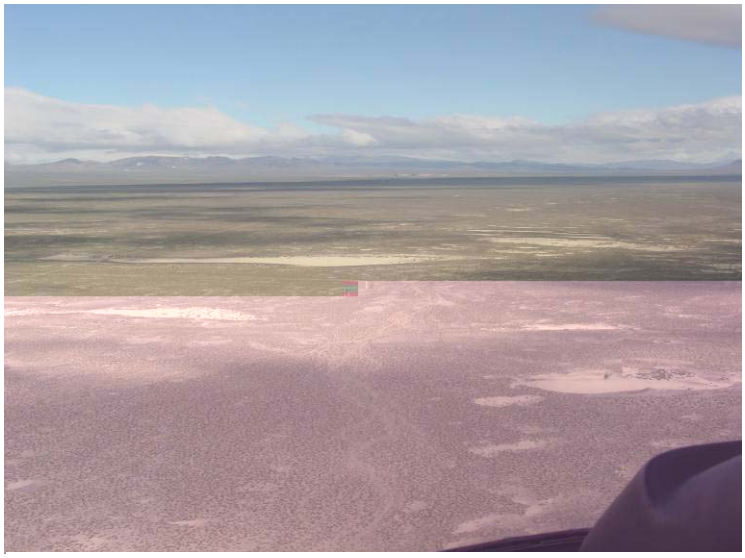
NAFB

NAFB lies in the northeastern portion of the broad Las Vegas Valley at about 1,900 ft elevation. The toes of alluvial fans extending south from the Las Vegas Range and northwest from Sunrise Mountain barely reach NAFB. Between these lies a broad, very gently sloping valley floor underlain mostly by fine-grained alluvial silts. Habitats in the vicinity of NAFB include sand dunes within the Las Vegas Dunes Recreation Area north of NAFB, alluvial fans below the Las Vegas Range, and Sunrise Mountain (east of NAFB). Topographic features in the NAFB area include the following:

- Sunrise Mountain
- Frenchman Mountain
- Dry Lake Range

NTTR

The topography over most of NTTR is undisturbed; however, some areas have been locally modified by man-made features including contonement facilities, sand and gravel pits, underground mining, drainage improvements, airstrips, landfills, fuel staging and storage areas, bombing targets, and cratering from aerial bombing. Air Force tactical target complexes and associated infrastructure have disturbed less than 5% of the topography (BLM, 2003).



Typical mountain/basin topography of the north range.

Because NTTR lies across 1.5 degrees of latitude and 1.75 degrees of longitude, and elevation varies more than 6,600 ft from the lowest to the highest points, a diversity of climatic zones lie within NTTR. Physiographically, the NTTR is dominated by its basin and range structure, where both mountain ranges and alluvium-filled valley floors have a general north-south trend (Fenneman, 1931). Elevation varies substantially, from about 1,900 ft to over 8,500 ft MSL. There is a marked rise in the basal elevations of Mojave/Great Basin valleys from about the latitude of Lake Mead to about the latitude of Tonopah. The valley bottoms of the South Range range from about 1,900 to 3,600 ft MSL. The maximum elevation of the surrounding mountains also has a tendency to increase from south to north. The mountain ranges reach over 6,000 ft in the South Range and over 8,500 ft in the North Range. In the latter, block-faulted mountains, composed of massive Paleozoic carbonate rocks, rise abruptly from their flanking bajadas. The bajadas themselves are prominent physiographic features in this area, and in the South Range they can attain relatively steep grades. Those bajadas that lie downwind of valley-bottom playas invariably support a sand sheet composed of sediments originating from the playas. Since the prevailing wind in this region is from the west, sand ramps mantle the bajadas of the west side of the Desert and Pintwater Ranges where they extend into the Three Lakes and Indian Springs Valleys, respectively. The lower portions of the

alluvial fans commonly attain grades of 5% or less and end at playas that occupy the floors of closed valleys.

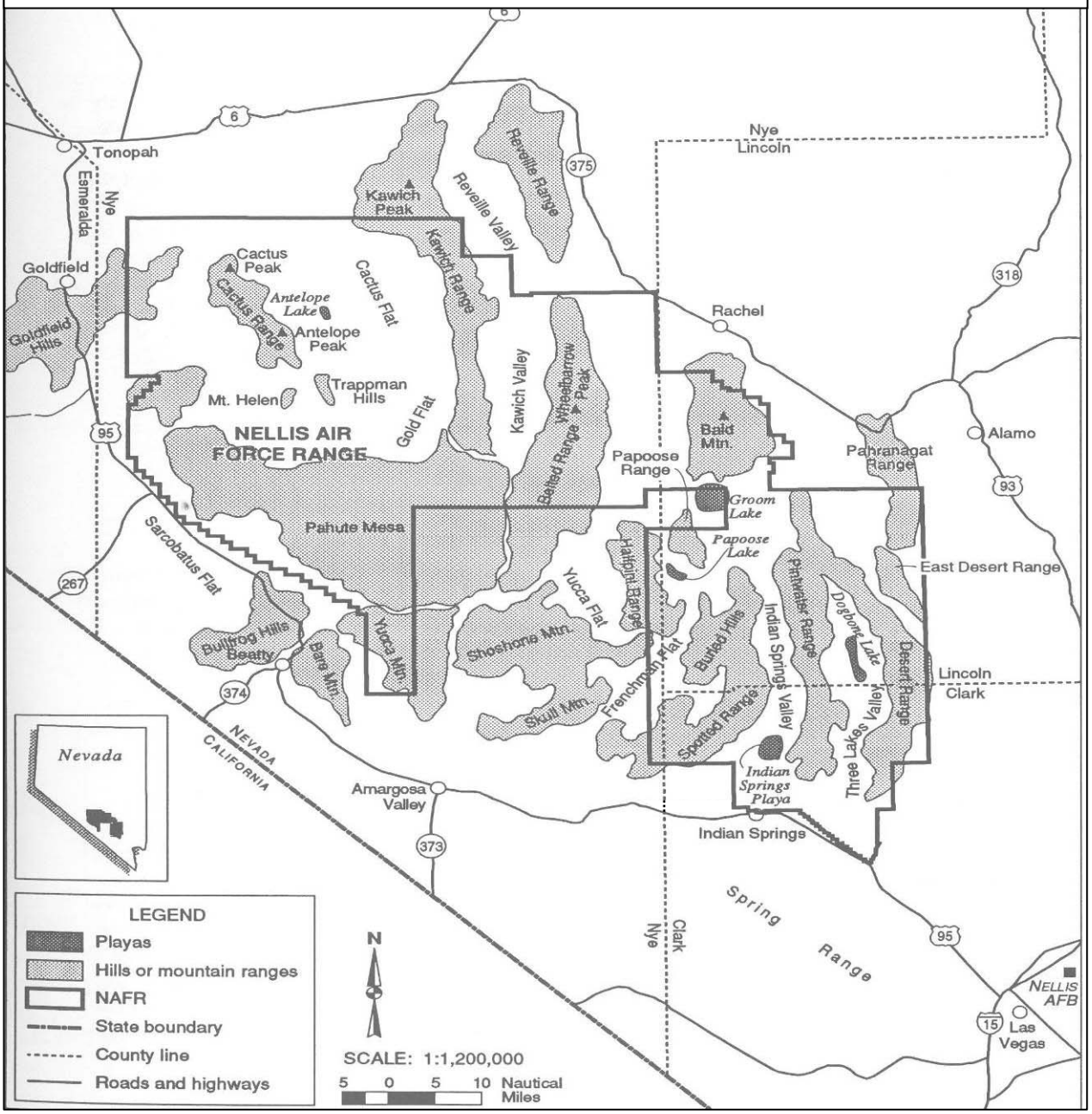
Mountainous topography commonly found in NTTR.

Although the North Range also lies within the Basin and Range physiographic province, the contrast between "basin" and "range" is not as pronounced in this area. This is partly because the topography that provides the bold contrast between the valleys and mountains of the South Range is buried under great accumulations of Tertiary volcanic rocks in the north. Vast expanses of ash that issued from volcanoes form the surface of western Pahute Mesa, and volcanic rocks comprise the mountains of this area (e.g. Timber, Stonewall, and Black Mountains, the Cactus and Kawich Ranges) (Cornwall, 1972). The massive outflow deposits of volcanic ash are more broken by faulting in the northern portions of the North Range (Ranges 71, 74, 75, 76, EC West, and EC East). Here, the valleys are broader than in the South Range and many of these valleys possess playas (e.g. Mud Lake, Stonewall and Cactus Flats). Figure 5.5 shows the major physiographic features found on NTTR.

The topographic landscape of NTTR links habitats, species, communities, and ecosystems without fragmentation, which inevitably occurs in areas outside of NTTR (Noss, 1992). Habitat fragmentation decreases, disturbs, or eliminates connections, which are often vital for migration and distribution of wildlife and plants. Outside NTTR, paved highways and agricultural areas to the west and highways and railroads to the east fragment regional habitats. The mountains of NTTR, which are not cut by highways, generally provide more undisturbed connectivity than that observed to either east or west. Also, the Mojave Desert mountain ranges southwest of NTTR are more isolated and may not provide wildlife migration routes as readily as the closely spaced series of ranges on NTTR. Therefore, NTTR, with its lack of major highways and agriculture, provides relatively uninterrupted north-south migration corridors for the Basin-and-Range Province.

Topographic conditions also allow NTTR to provide a protected, relatively undisturbed area in which species can exist without being affected by civilian development and a broad spectrum of other human activities. Since Air Force operations directly affect only a small fraction of the withdrawn land, NTTR creates a refuge-like condition on more than 95% of the land area. Based on limited available information, many areas, especially the mountain ranges, appear to be in relatively pristine ecological condition, even though historic livestock grazing, mining and associated roads, the presence of wild horses, military operations, and historic nuclear testing activities have disturbed localized areas, especially valley floors.

Figure 4-5. Major physiographic features found on NTTR.
(Source: Air Force, 1999)



4.2.2 Needs Assessment

Need: For proper management of NAFB and NTTR, a GIS database with current topographic features including contours and digital elevation maps is required.

Current Assessment: A GIS layer has been developed for NAFB and Indian Springs AF AUX/90 that contains elevation contours at 2-ft intervals. In addition, a contour layer with 100 ft. contours is available for NTTR. However, a GIS layer providing information on topographic and

physiographic features other than contours is lacking for NAFB. Using the ArcView Spatial Analyst and 3-D Analyst, grid layers can be developed from the contour layers. These in turn can be used to prepare detailed digital elevation maps and layers that show the aspect and slopes of the areas. Slope, aspect, and elevation all have significant influence on the location and development of habitat conducive to rare plants and species of concern. This information is critical for use in preparing natural resource sensitivity models for planning and management of natural areas.

Need: Aerial photography of NTTR should be conducted and updated every 5 years for monitoring natural resources.

Current Assessment: Recent aerial photography has been completed and incorporated into the GIS database for NAFB. Aerial photographs provide information critical for proper and efficient management of natural resources. A complete 1999 set of aerial photographs is available for NTTR, but a more recent set is needed and should be updated every five years.

4.2.3 Management Goals within the Mission

The military mission dictates that NAFB test and train military personnel in areas that replicate combat topography and environments. Therefore, these INRMP goals must be attained within the constraints of the military mission. Meeting these goals will assist in reducing the consultation time required for compliance with the Endangered Species Act, Clean Water Act, and NEPA.

GOAL 1: Maintain the ecological connectivity within the range area to encourage the migration and distribution of wildlife in the Great Basin and Mojave Desert.

GOAL 2: Minimize impacts to undisturbed areas within NTTR and NAFB where topography provides unique habitat while maintaining mission integrity.

GOAL 3: Complete development of the topographic component of the natural resource GIS database.

4.2.4 Management Guidelines

The military mission always takes precedence over the guidelines recommended in the INRMP. Managers should adhere to the guidelines within the constraints of the mission.

- **Roads and utility easements should be configured in a manner so as not to cause breaks in connections and migration routes between wildlife communities. This is best accomplished by allowing roads to follow the topography of the area. In other words, the roads and utility easements should be designed such that the majority of the rights-of-way (ROWs) follow the general direction of mountain ranges and valleys rather than cutting across them.**
- **Where practical, maintained easements for utilities should be avoided. Access roads should be maintained, but natural vegetation should be managed to encourage the development of a natural plant community with minimal encroachment by weeds and other invasive species after construction, if possible.**

4.2.5 Projects

Project	Goal	Project Name	Due Date
1. Complete the elevation contour GIS layers for NTTR. Incorporate these into the natural resource database. Also include USGS quad sheets in UTM NAD 83 Zone 11N.	3	Range, GIS Database & Aerial Photography	Completed
2. Using ArcView Spatial Analyst and 3-D Analyst, develop new GIS layers to include topographic features, digital elevation grids, slope, and aspect for NTTR and NAFB.	3	Range, GIS Database & Aerial Photography	Completed
3. Using information from GIS layers, a sensitivity layer for the natural resource database should be developed for topographic features showing location of areas sensitive to mission activities and the location of topographic characteristics that may impact the mission (rugged terrain, sinkholes, etc.). Sensitivity will be based on the potential for the feature to recover from impacts impinged by mission activities. This layer will be combined with sensitivity layers developed for other natural resources and used to develop an overall natural resource sensitivity map which will be used to assist resource managers in planning mission activities.	1,2,3	Range, GIS Database & Aerial Photography	December 2007

4.2.6 References

Literature Cited

Cornwall, H. R. 1972. Geology and mineral deposits of southern Nye County, Nevada. Nevada Bureau of Mines and Geology Bulletin 77, University of Nevada, Reno.

Fenneman, F. N. 1931. *Physiography of the Western United States.* McGraw-Hill, New York.

U.S. Air Force. 1999. Renewal of the Nellis Air Force Range Land Withdrawal. Department of the Air Force. Legislative Environmental Impact Statement.

Additional References

EG&G. 1991. The Distribution and Abundance of Desert Tortoises on the Nevada Test Site. Nellis AFB, Nevada.

Nellis Air Force Base. 1997. Nellis Air Force Base and Range Bat Survey Report. Nellis Air Force Base, Nevada.

Nellis Air Force Base. 2002. Draft Environmental Baseline Study: Nellis Terrace Housing Area. Nellis Air Force Base, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Water Wells Annex. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Manch Manor Housing Area. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Dunning Circle Housing Area. Nellis AFB, Nevada.

U.S. Air Force Air Combat Command. 1997. Mineral and Energy Resource Assessment of the Nellis Air Force Range. Final Report: Volumes 1 and 2. Nellis Air Force Base, Nevada.

U.S. Army Corps of Engineers, Omaha District. 2001. Environmental Assessment: Live Ordnance Departure Area (LODA) at Nellis Air Force Base. Prepared for Environmental Management Office, 99 CES, Nellis AFB, Nevada.

4.3 GEOLOGY

4.3.1 Description of Current Conditions

The geologic formations outcropping on NTTR and NAFB can be divided into the southeastern area, which is mostly Paleozoic sedimentary rocks, and a northwestern area, which is dominated by volcanic rocks of the Cenozoic age (NBMG 1997).

4.3.1.1 NAFB

NAFB lies in the Las Vegas Valley, which is predominantly sedimentary formations and alluvial deposits. The sedimentary formations are found in mountain ranges and consist mainly of limestone mixed with sandstone, shale, dolomite, gypsum, and interbedded quartzite. The alluvial fans found to the east and north of NAFB are composed of many coalescing fans dissected by numerous drainage channels. In the upper reaches, these alluvial fans are comprised of poorly sorted gravelly, cobbly, and stony sand deposits that grade to finer textured material towards the valley floors. Basin floors are depositional areas of late-laid silt and clay and younger alluvial deposits. Most of these alluvial deposits have been transported by water and deposited on the sloping basin floors of the floodplains. The deposition of alluvium is a continuing process.

Geologic formations are often critical for providing cover for wildlife. In this picture, a desert bighorn ewe is protecting her lamb by hiding in a crevice between rocks.

4.3.1.2 NTTR

In NTTR, the mountain ranges in the South Range are dominated by Paleozoic carbonate rocks mixed with smaller amounts of quartzite, sandstone, and shale. Valleys in this area contain thick deposits of alluvium originating from erosion of adjacent mountain ranges. Sedimentary rocks originating from lakes and rivers have been deposited in shallow basins and outcrop in several areas within NTTR, particularly in the southern Spotted Range, the Pintwater Range, and the Desert Range. Older Tertiary valley-fill sediments which were uplifted with the underlying Paleozoic bedrock are exposed on the flanks of the mountains (Longwell et al. 1965; NBMG 1997).

Volcanic rocks dominate the geology of the northern ranges. The Timber Mountain caldera is one of several centers of volcanic activity in the northern range. Other such centers include the Black Mountain, Cactus Range, and Silent Canyon calderas, and Mount Helen dome. Volcanic tuff originating from the volcanic centers extends throughout the North Range including the extensive tableland of western Pahute Mesa, the southern Cactus and Kawich Ranges, and Stonewall Mountain (Cornwall 1972 and NBMG 1997).

Figure 4-6 shows the faults that have been documented within NTTR and NAFB. It is obvious that the tectonic history of the region is very complex. Most of these faults are a result of regional thrust, folds, and wrench faults developed during compressional deformation associated with mountain building, which rearranged the position of sedimentary rocks in southern Nevada. A more detailed discussion of faults in southern Nevada can be found in Armstrong (1968) and Caskey and Schweickerty (1992). The western one-third of NTTR is located within Seismic Zone 3, while the eastern two-thirds of NTTR and NAFB are located in Seismic Zone 2B. Seismic Zone 3 is considered an area with major damage potential, while Seismic Zone 2B is considered an area of moderate damage potential. The Yucca fault, located in the south-central portion of NTTR, is the only fault that is considered active based on displacement of surface alluvium. Other active faults may also occur on NTTR. Several inactive or potentially active faults are also present at NTTR. These faults include the Carpetbag fault located west of the Yucca fault and the Pahranagat fault system located in the South Range. Most faults on NTTR and NAFB are considered inactive.

For more details on the geology of NTTR and NAFB, please refer to the references at the end of this section.

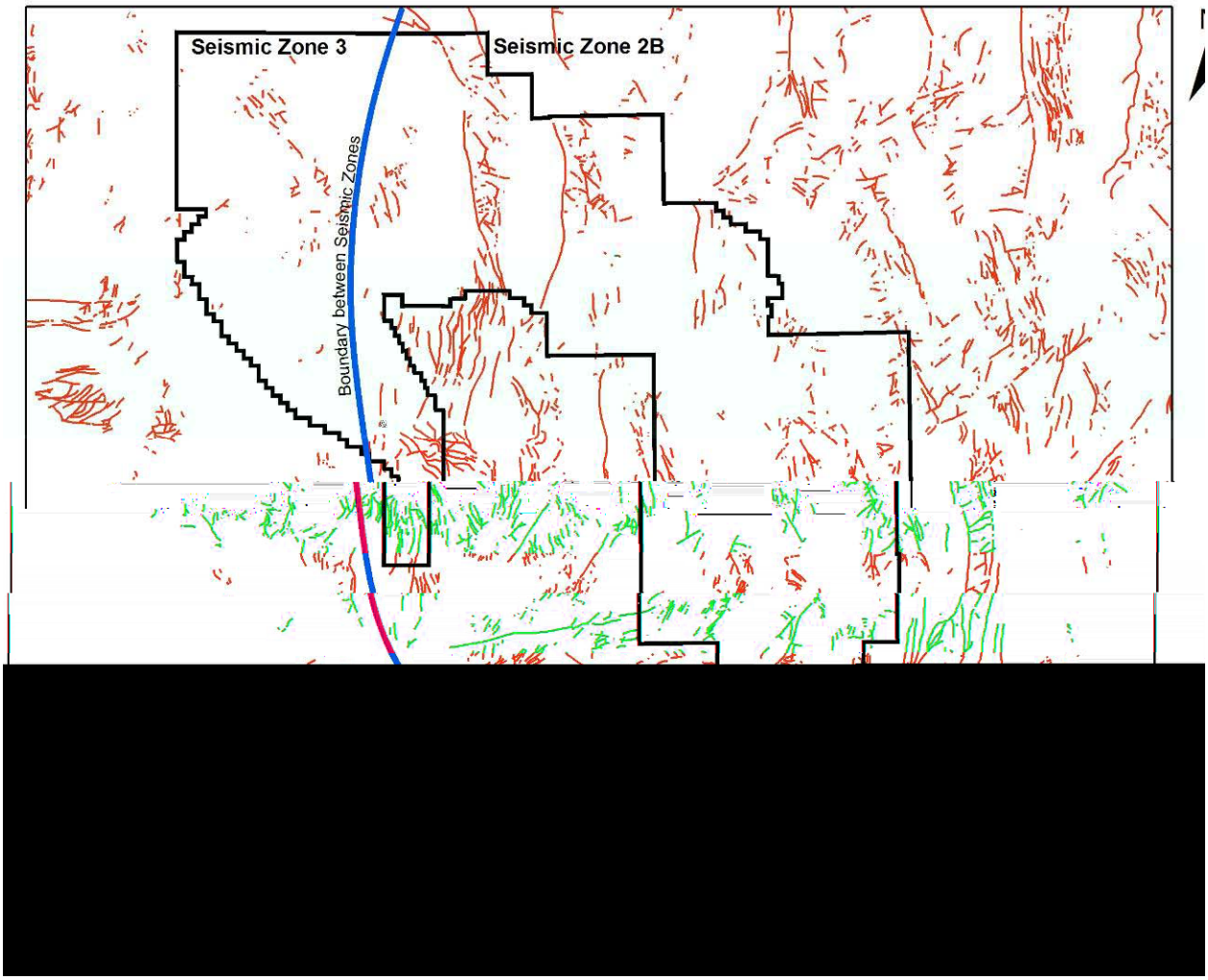
4.3.2 Needs Assessment

Need: Maps showing the geology of NTTR and NAFB are needed for efficient mission planning and management.

Current Assessment: General maps of the geology of NTTR and NAFB have been developed by the State of Nevada. These maps were prepared using aerial photographs and some ground-truth data. In addition, the State of Nevada has mapped the general location of faults found within NTTR and NAFB (Figure 4-6). This information should be incorporated into the GIS database for use in natural resource planning.

Figure 4-6. Faults and seismic zones found on NAFB and NTTR.

Source: University of Nevada, Reno.



Maps providing accurate locations of geologic outcrops at NTTR are not available. In addition, accurate information on faults and other evidences of tectonic activity is somewhat lacking. An accurate knowledge of geologic outcrops also allows biologists to predict potential habitat for various plant and animal species of concern. For example, the Las Vegas bearpoppy and the Las Vegas buckwheat are both adapted to gypsum outcrops commonly found in the alluvial fans and basins in and around NAFB. Additionally, specific geologic strata are more conducive to use by desert tortoises.

Often mission activities require specific environments to mimic those being encountered by troops in combat. These specific areas may require certain types of geology such as areas supporting caves, steep slopes, crevices, cliffs, canyons, etc. An accurate geologic map could assist in finding locations for mission activities and streamline the siting process.

In summary, improved, accurate mapping of geologic formation outcrops is critical to proper management of natural resources within NTTR and NAFB. At the present time, these are lacking. This information should be collected and incorporated into the natural resource database.

4.3.3 Management Goals within the Mission

GOAL 1: Develop more accurate geologic outcrop maps for NTTR and NAFB.

GOAL 2: Develop map layers for the natural resource database that include the locations of geologic outcrops and faults. Much of this information could be obtained from the University of Reno and other state agencies.

GOAL 3: Identify and conserve unique geologic resources on NTTR and NAFB as applicable. These resources often provide unique habitat for species of concern. Thus, potential problem areas and issues can be identified and avoided prior to construction or implementation of any action preventing delays to the mission caused by intervention and consultation by the USFWS and state agencies.

4.3.4 Management Guidelines

The military mission always takes precedence over the guidelines recommended in the INRMP. Managers should adhere to the guidelines within the constraints of the mission.

Prior to initiation of construction, the following steps should be taken:

- **Potential project sites should be screened using the natural resource database to determine potential for the presence of geologic features that may be sensitive to the proposed action or may impact the proposed action. Facilities should be sited to minimize or avoid sensitive areas or other issues.**
- **Site-specific geologic outcrops should be field surveyed on the selected site to identify any issues that may have not been covered by natural resource database maps. This information should be incorporated into the database as it is collected.**
- **Once the outcrops have been identified, any areas that could be significantly impacted by construction activities should be avoided where practical.**
- **Geologic outcrops known to support species of concern should be surveyed prior to construction to determine if any species of concern are present.**

Specific formations that should be considered in construction include the following:

- **Formations that have a high potential for subsidence**
- **Formations with a high potential for structural instability**
- **Formations with known shallow aquifers or conduits to deep aquifers**
- **Formations with high potential for wind and water erosion**
- **Formations potentially supporting species of concern**

4.3.5 Projects

Project	Goal	Project No.	Due Date
1. Map and delineate geologic formations located in NTTR and NAFB using current geologic maps, aerial photography, and limited ground-truth data. This project will be an on-going project that will concentrate on each range area prioritized according to the level of impacts impinged by the current activities. Soils and vegetation will be mapped in conjunction with this project. In the time frame of this INRMP, the following areas should be mapped and incorporated into GIS:			
a. Range 62S and 62N	1,2	New: Vegetation/Soils/ Geo Survey	Dec. 2008
b. Range 76	1,2	New: Vegetation/Soils/ Geo Survey	Dec. 2009
c. Range 65S and 65N	1,2	New: Vegetation/Soils/ Geo Survey	Dec. 2010
d. Range 74A, 74B, and 74C	1,2	New: Vegetation/Soils/ Geo Survey	Dec. 2011
e. Range 64A, 64B, 64C and 64D	1,2	New: Vegetation/Soils/ Geo Survey	Dec. 2012
f. Range 71N and 71S	1,2	New: Vegetation/Soils/ Geo Survey	Dec. 2013
2. Incorporate currently available maps showing geologic formations, faults, and seismic zones into the natural resource database.	2	Range, GIS Database & Aerial Photography	Completed
3. Continually update the geology layers for the natural resource database as new data is collected and new findings are made. Geotechnical data collected for construction sites should be incorporated into the natural resource database for future reference.	2,3	Range, GIS Database & Aerial Photography	Annual
4. Develop a sensitivity map layer based on geology to assist in the siting of new construction projects and targets.	3	Range, GIS Database & Aerial Photography	Annual

4.3.6 References

Literature Cited

Armstrong, R. L. 1968. Sevier Orogenic Belt in Nevada and Utah. Geological Society America Bulletin 79(4): 429-458.

Black, Stuart C., Wayne M. Glines and Yvonne E. Townsend. 1995. U.S. Department of En-

ergy Nevada Operations Office Annual Site Environmental Report 1994.

Caskey, S. J. and R. A. Schweickerty. 1992. Mesozoic Deformation in the Nevada Test Site and Vicinity: Implications for the Structural Framework of the Cordilleran Fold and Thrust Belt and Tertiary Extension North of Las Vegas Valley. Tectonics 11(6): 1314-1331.

Cornwall, H. R. 1972. Geology and Mineral Deposits of Southern Nye County, Nevada. Nevada Bureau of Mines and Geology Bulletin 77, University of Nevada, Reno.

EG&G. 1991. The Distribution and Abundance of Desert Tortoises on the Nevada Test Site. Nellis AFB, Nevada.

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.

Nevada Bureau of Mines and Geology (NBMG). 1997. Mineral and Energy Resource Assessment of the Nellis Air Force Range, Volumes 1 and 2.

Nicoletti, Mary Jo. 1991. Mojave Desert Tortoise Survey at Range 63. Nellis AFB, Nevada.

U.S. Department of Energy (DOE). 1996a. Final Environmental Impact Statement for the Nevada Test Site and Off-Site Locations in the State of Nevada, DOE/EIS-0243. Nevada Operations Office, Las Vegas. August.

Additional References

Black, Stuart, Glines, Wayne, and Townsend, Yvonne. 1994. Annual Site Environment Report. 2-7 – 2-13.

Department of the Air Force. 1999. Renewal of the Nellis Air Force Range Land Withdrawal Legislative Environmental Impact Statement. Nellis AFB, Nevada.

EG&G Energy Measurements. 1991. The Distribution and Abundance of Desert Tortoises on the Nevada Test Site. 3.

Ekren, E.B. 1968. Geologic Setting of the Nevada Test Site and Nellis Air Force Range.

Ekren, E.B., Anderson, R.E., Rogers, C.L., and Noble, D.C. 1961. Geology of Northern Nellis Air Force Base Bombing and Gunnery Range. Nye County, Nevada.

Nellis Air Force Base. 2002. Draft Environmental Baseline Study: Nellis Terrace Housing Area. Nellis Air Force Base, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Water Wells Annex. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Manch Manor Housing Area. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Dunning Circle Housing Area.

Nellis AFB, Nevada.

Nellis Air Force Base. 1997. Bird Survey Report. Air Force Project No. RKXF956145. Nellis AFB and Nellis Air Force Range, Nevada.

Nevada Environmental Consultants, Inc. 1998. Biological Assessment: Bureau of Land Management Lands Selected for Withdrawal. 5.

Nevada Environmental Consultants, Inc. 1999. Volkmar Land Exchange Proposal and Nellis Air Force Base Withdrawal. 15, 17-18.

Sinnock, Scott. 1982. Geology of the Nevada Test Site and Nearby Areas. Southern Nevada.

Speck, R. L., 1985. Soil Survey of Las Vegas Valley Area, Nevada, part of Clark County, U.S. Department of Agriculture, Natural Resource Conservation Service, p. 3.

United States Department of Defense Legacy Resource Management Program. 1997. An Inventory of 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, Part A: The Inventory.

U.S. Air Force. 1996. Summary of Bird Surveys. Nellis Air Force Range. 2-3 – 2-11.

U.S. Air Force. 1998. Water Requirements Study of the Nellis Air Force Range.

U.S. Air Force Air Combat Command. 1997. Mineral and Energy Resource Assessment of the Nellis Air Force Range. Final Report: Volumes 1 and 2. Nellis Air Force Base, Nevada.

U.S. Army Corps of Engineers, Omaha District. 2001. Environmental Assessment: Live Ordnance Departure Area (LODA) at Nellis Air Force Base. Prepared for Environmental Management Office, 99 CES, Nellis AFB, Nevada.

U.S. Department of the Air Force. 1997. Final Floodplain Inventory Report. Nellis Air Force Range, Nevada.

U.S. Department of the Air Force. 1999. Renewal of the Nellis Air Force Range Land Withdrawal. 3.5-1 – 3.5-38, 3.6-10.

U.S Department of Defense Legacy Resource Management Program. 1997. An Inventory of Rare, Threatened, Endangered, and Endemic Plants and Unique Communities on Nellis Air Force Bombing and Gunnery Range. Clark, Lincoln, and Nye Counties, Nevada. 11.

U.S. Department of the Interior. 1991. Nellis Air Force Range Resource Plan and Record of Decision. 13.

4.4 MINERAL RESOURCES

4.4.1 Description of Current Conditions

The Department of the Air Force, per Public Law 106-65, Military Lands Withdrawal Act of 1999, Subtitle A, Section 3011(b)(1), declares that the lands under the Nevada Test and Training Range are closed to public access. They are specifically withdrawn from all forms of appropriation under the mining laws, the mineral leasing laws, and the geothermal laws. The Air Force has no lands suitable for these activities and will continue to enforce current public access policy. According to PL 106-65 as amended, the Secretary of the Interior must determine, at least every five years, whether it is suitable to open any withdrawn lands for mineral resource entry.

The intent of this decision is based on three factors: (1) to protect the public from injury due to ordnance hazards; (2) to ensure national security is not compromised; and (3) to ensure that military programs can be conducted without interruption.

The NBMG conducted rather extensive studies of mineral resources that have been discovered on NTTR. As part of the project, NBMG mapped areas potentially containing various mineral resources including precious metals, metallic minerals, and non-metallic industrial minerals. The study is well documented in NBMG (1997) and summarized in Air Force (1999). Resource managers requiring detailed information on mineral resources should refer to those references.

NTTR had been mined since the 1860s. Most of the gold and silver deposits were discovered and mined in the early 1900s, although some mining efforts occurred sporadically until 1942, when NTTR was closed to mining. With the exception of the Groom Mountain Range, little or no mineral exploration or related activity has been allowed in the last 50 years. This particular area contains one unpatented mining claim, 16 patented mining claims, and all or portions of two oil and gas leases. Minerals discovered at NTTR include gold, silver, copper, lead, zinc, mercury, tungsten, and turquoise. In addition, commercial grade sand, gravel, and limestone are also found in NTTR. Potentially valuable deposits of sodium, potassium, alunite, and potash also occur in NTTR. Significant deposits of gypsum and limestone have been produced from areas adjacent to NTTR and NAFB.

Mineral resources should be considered in the INRMP in an effort to identify any areas that could potentially be developed as borrow pits in the future. Aggregates and base materials are always needed for roads and facility construction. 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 the geothermal leasing laws. Mineral extraction is limited to sand and gravel quarrying by the USAF or its contractors to support the development of on-site infrastructure. All quarrying activities must be reviewed by the natural resources manager via Form 813 to determine if the activity qualifies as a categorical exclusion or if an environmental assessment or environmental impact statement is required. The natural resource manager must monitor and manage all of these activities.

4.4.2 Needs Assessment

Need: The information collected by NBMG has not been incorporated into the natural resource database.

Assessment: As previously mentioned, a comprehensive assessment of mineral resources at NTTR has been conducted by the NBMG. This assessment provides in-depth information on the location of mines at NTTR and the potential for discovery of mineral resources across NTTR. The data should be collected from NBMG and incorporated into the natural resource database. Layers should be scored according to sensitivity to impacts and potential for development of mines or borrow pits.

4.4.3 Management Goals within the Mission

GOAL 1: Incorporate mineral resources maps from NBMG into the natural resource database.

GOAL 2: Maintain up-to-date records concerning the location of active mines, borrow pits, and extraction of any mineral resources by the Air Force while mines are withdrawn from public use. Current information should be incorporated into the natural resource database.

4.4.4 Management Guidelines

The military mission always takes precedence over the guidelines recommended in the INRMP. Managers should adhere to the guidelines within the constraints of the mission.

- **Areas currently used for extraction of sand and gravel within NTTR are mapped and currently monitored by 99th CEVC to comply with the Title V Air Permit. Data collected should be shared and centrally stored on the ESOHMS web page.**
- **CEVC will coordinate with 98th RANW to ensure that all borrow pits are mapped in GIS and extracted quantities are incorporated into the natural resource database to allow for expeditious production of an annual report to BLM and NDEP.**
- **In addition to borrow pits, all mines and mining areas should also be mapped in GIS and incorporated into the natural resource database.**
- **All current information on mineral resources at NTTR and NAFB should incorporated into the natural resource database and scored according to potential for use and sensitivity to development.**

Before any construction occurs, the project manager should:

- **Use the natural resource database to determine the potential for impacts to mineral resources.**
- **Identify potential impacts to the project as well as human health with respect to mineral resources, especially radioactive and other natural hazardous materials.**
- **Identify the potential for rendering any mineral resources as an irreversible and irretrievable resource per NEPA following the project.**
- **Identify any permitted mines in the project area and determine if the project will impact the operation of the mine in the future.**

4.4.5 Projects

Project	Goal	Project No.	Due Date
1. Develop a GIS database from the NBMG report that provides information as to the location and characteristics of mines and borrow pits in NTTR. Data on amount of borrow removed could be included in the database.	1,2	Range, GIS Database and Aerial Photography	December 2007

4.4.6 References

Literature Cited

Nevada Bureau of Mines and Geology (NBMG). 1997. Mineral and Energy Resource Assessment of the Nellis Air Force Range, Volumes 1 and 2.

U.S. Department of the Air Force. 1999. Renewal of the Nellis Air Force Range Land Withdrawal. Legislative Environmental Impact Statement. Volume 1. Pages 3.5-4 through 3.5-11.

Additional References

Black, Stuart, Glines, Wayne, and Townsend, Yvonne. 1994. Annual Site Environment Report. 2-7 – 2-13.

EG&G Energy Measurements. 1991. The Distribution and Abundance of Desert Tortoises on the Nevada Test Site. 3.

Ekren, E.B. 1968. Geologic Setting of the Nevada Test Site and Nellis Air Force Range.

Ekren, E.B., Anderson, R.E., Rogers, C.L., and Noble, D.C. 1961. Geology of Northern Nellis Air Force Base Bombing and Gunnery Range. Nye County, Nevada.

Nellis Air Force Base Cultural Resources Management Staff. 2001. Mining and Archaeological Sites on the North Nevada Test and Training Range. Nellis AFB, Nevada.

Nevada Environmental Consultants, Inc. 1998. Biological Assessment: Bureau of Land Management Lands Selected for Withdrawal. 5.

Nevada Environmental Consultants, Inc. 1999. Volkmar Land Exchange Proposal and Nellis Air Force Base Withdrawal. 15, 17-18.

Sinnock, Scott. 1982. Geology of the Nevada Test Site and Nearby Areas. Southern Nevada.

U.S. Air Force. 1996. Summary of Bird Surveys. Nellis Air Force Range. 2-3 – 2-11.

U.S. Air Force. 1998. Water Requirements Study of the Nellis Air Force Range.

U.S. Air Force Air Combat Command. 1997. Mineral and Energy Resource Assessment of the Nellis Air Force Range. Final Report: Volumes 1 and 2. Nellis Air Force Base, Nevada.

U.S. Army Corps of Engineers, Omaha District. 2001. Environmental Assessment: Live Ordnance Departure Area (LODA) at Nellis Air Force Base. Prepared for Environmental Management Office, 99 CES, Nellis AFB, Nevada.

U.S Department of the Air Force. 2002. Draft Environmental Baseline Survey: Nellis Terrace Housing Area. 3-23 – 3-24.

U.S. Department of the Air Force. 1997. Final Floodplain Inventory Report. Nellis Air Force Range, Nevada.

U.S. Department of the Air Force. 1999. Renewal of the Nellis Air Force Range Land Withdrawal. 3.5-1 – 3.5-38, 3.6-10.

United States Department of the Interior, Bureau of Land Management, Las Vegas District. 1992. Nellis Air Force Range Resource Plan and Record of Decision. Nellis Air Force Base, Nevada.

4.5 SOILS

4.5.1 Description of Current Conditions

As previously discussed, geologic outcrops are very important in natural resource management due to the fact that the nature and characteristics of those outcrops have far-reaching impacts on the composition of the vegetative communities that can exist within the chemical and physical parameters determined by the outcrop. However, soils are actually the more refined features of geologic outcrops or parent material, altered by nature's physical and chemical processes. Once outcrops are exposed to climatic and topographic conditions, they are transformed into various types of soils, each of which supports unique plant communities adapted to the physical and chemical characteristics of the soil as modified by climatic conditions. Thus, vegetative communities can be predicted by identifying specific soil mapping units, topographic features, and hydrologic features within a specific area. The vegetative community, in turn, greatly influences the establishment of terrestrial and aquatic wildlife species inhabiting the area.

Thus, for the natural resource manager, accurate information concerning soils is extremely important. This enables the manager to determine potential locations of various plant and animal communities as well as the expected time for impacted plant communities to return to their original, or even climactic successional stages.

4.5.1.1 NAFB

The NRCS has currently mapped most of the soils on NAFB. The exception to this is those soils located in the eastern half of Area II of NAFB as well as those soils found in and around Sunset Mountain. Figure 4-7 shows the soils that have been currently mapped for NAFB. Most of the soils at NAFB are alluvial soils produced by erosion and wash of soils from surrounding mountains. This is very common in the basins in and around the Las Vegas Valley. A majority of the soils in Area III contain relatively high levels of gypsum, which provides an environment

conducive to the growth of the Las Vegas bearpoppy and the Las Vegas buckwheat. Other areas containing gypsum soils are scattered throughout NAFB and may also support these plants.

In the vicinity of NAFB proper, tectonic activity has been less than in areas closer to the mountain fronts. Tertiary and early Quaternary valley fill lies at shallow depth. The upper soil layer on the NAFB is light brown sandy loam with gravel and clay-rich sand. The average depth of topsoil ranges from 15 to 60 cm. Below 60 cm are strata of caliche, which are often impenetrable to water and physical disturbance. The topsoil is loose and dry silt in some areas. Internal drainage is normally good above caliche strata, but poor at and below that point. Soil in this area is subject to extreme wind erosion due to sparse vegetation and seasonal high winds. Where required, erosion can be minimized by the use of dust palliatives and cultured vegetation. Alkalinity may be a problem for some plantings. However, a lower pH can be established by the application of soil amendments as recommended by the manufacturer.

The alluvial soils that are commonly found in fans and basins often contain very fine soil particles that can be subject to wind erosion. This creates fugitive dust issues, which can be accentuated by off- and on-road vehicular traffic and loss of topsoil caused by construction or wildlife grazing activities.

In general, soils found on NAFB are one of three associations:

- Glencarb association: Very deep soils found on floodplains and along alluvial fans.
- Weiser-Dalian association: Very deep soils found on alluvial fan remnants, fan skirts, and inset fans. Other than their droughty nature, the limiting factors for these soils primarily associated with their susceptibility to wind erosion. Water erosion is mainly a problem in drainage areas and only occurs following intense storm events.
- Cave-Las Vegas-Goodsprings association: Shallow and very shallow soils found on alluvial remnants.

Gypsiferous soils that support Las Vegas bearpoppy and Las Vegas buckwheat.

Figure 4-7. Soil Map Units found on NAFB and vicinity as shown in the soil survey.

Source:Speck, R.L. 1985. Soil Survey of Las Vegas Valley Area, Nevada Part of Clark County. Natural Resource Conservation Service.

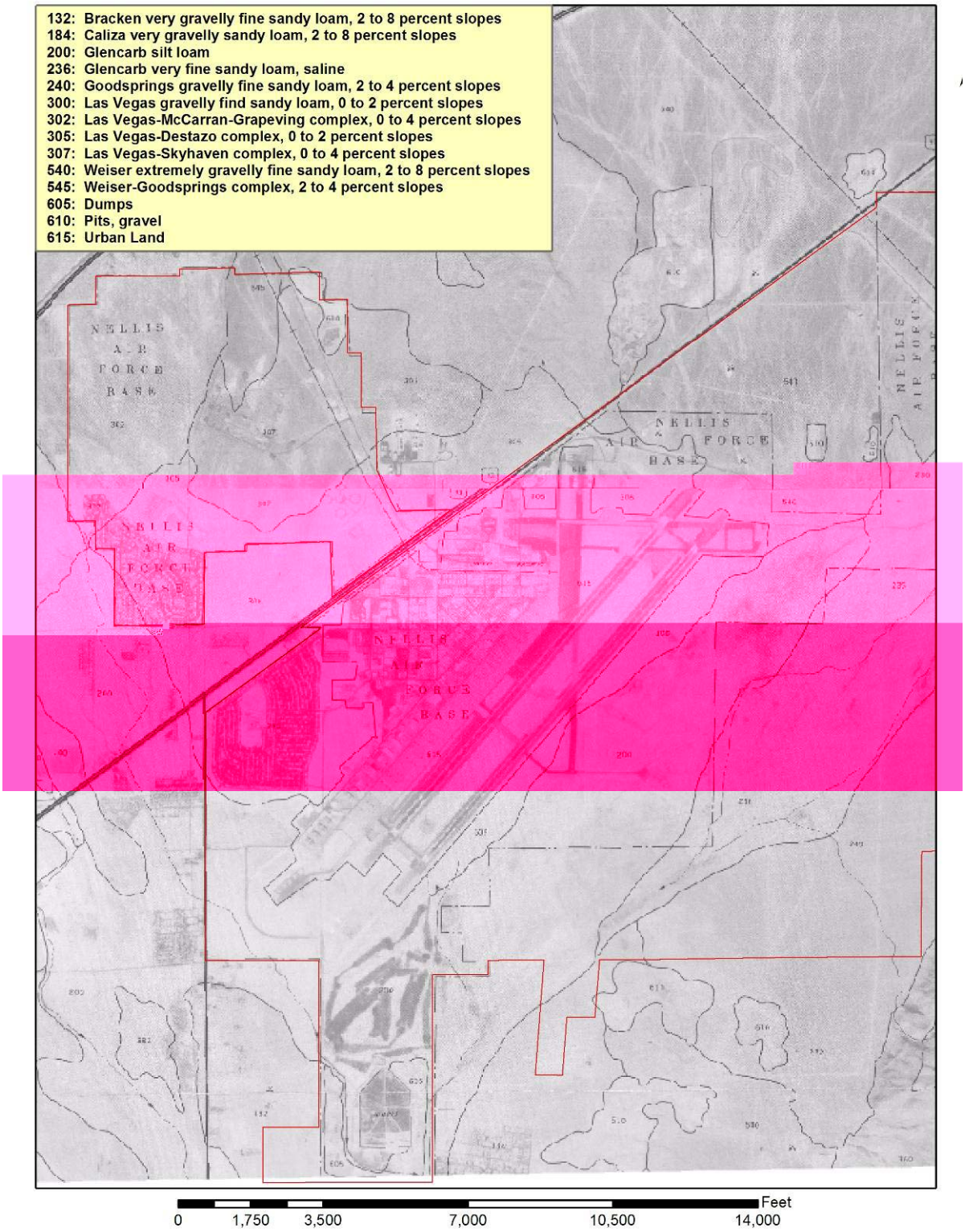
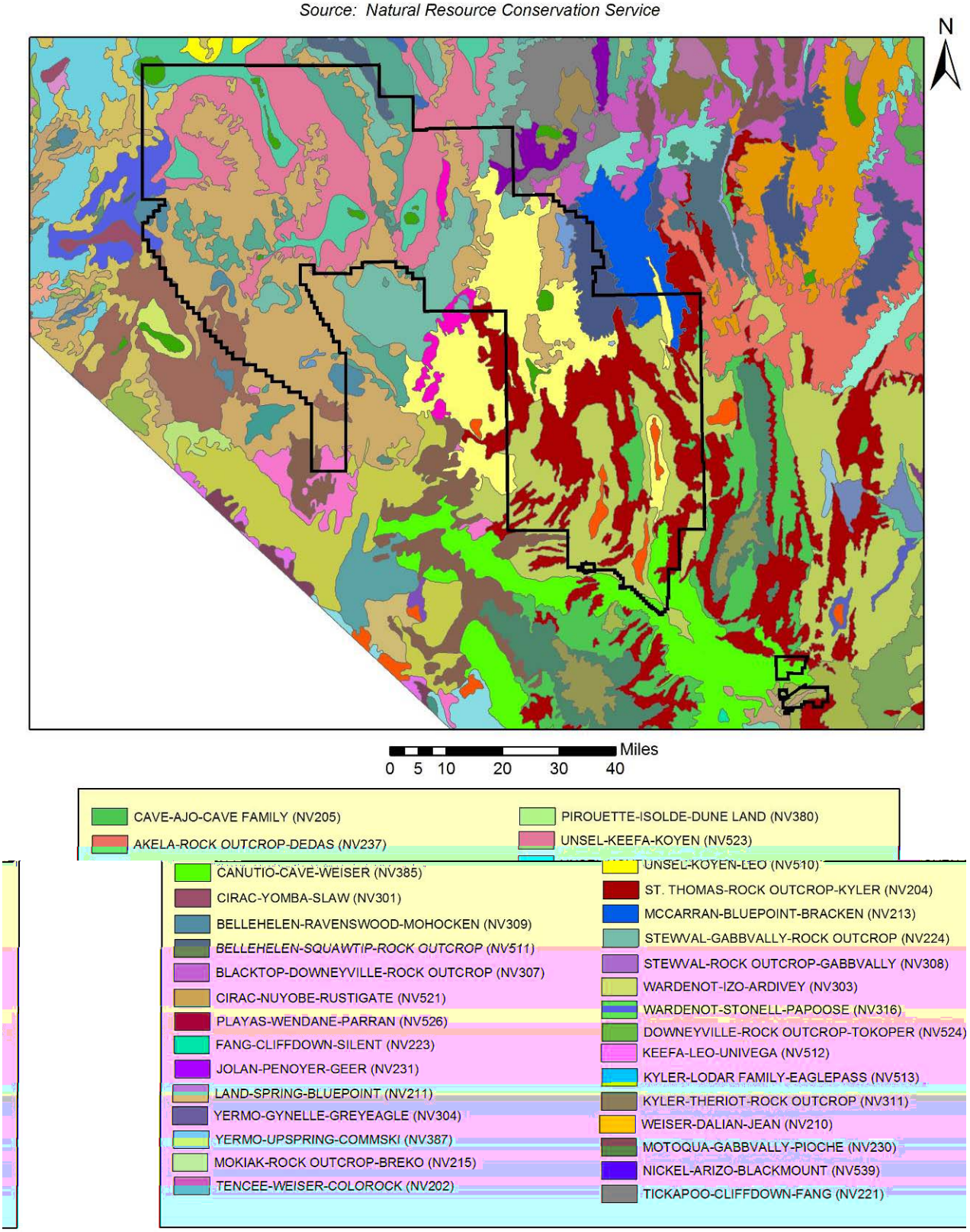


Figure 4-8. General soil associations found on NAFB and NTTR.

Source: Natural Resource Conservation Service



4.5.1.2 NTTR

In general, soils of the South Range are predominantly alluvial soils derived from carbonate parent material. Because the North Range receives substantially greater effective moisture, and because the soils there are developed largely on volcanic parent material, the A horizons are typically better developed. They frequently possess a noticeable organic component in relatively dense scrub and woodland habitats. The B horizons, as in the South Range, have a cumulic character due to the substantial influx of silt and clay-sized particles. Carbonate horizons are commonly developed in the older parent material, with most carbonate originally coming from dust.

The soils on NTTR have not been mapped in detail; however, soils associations have been mapped by the NRCS using satellite photography and other sources (Figure 4-9). These maps are available through the NRCS via the Internet using the SURGO soil mapping site. More specific soils for portions of NTTR can also be found on the STATSGO Internet site, but most of NTTR has not been mapped at that level of detail. General soil associations found on NTTR include the following:

- St. Thomas series: This soils is primarily shallow, well drained, and formed in colluvium and residuum from limestone and dolomite. These soils are primarily found in the mountainous areas, on hills, and mountains with 8 to 75 percent slopes.
- Crosgrain series: This soil is found on alluvial fan piedmonts and is a shallow, well drained soil formed in mixed alluvium on older fan piedmonts with slopes of 4 to 30 percent.
- Arizo series: This soil is also commonly found on fan piedmonts but are very deep, excessively drained soils formed in mixed alluvium on more recent alluvial fans with slopes from 0 to 15 percent.
- Mazuma series: Very deep, well-drained soils that formed in alluvium and lacustrine materials from various rock sources. These soils commonly occur on fan skirts and alluvial flats with slopes of 0 to 15 percent.
- Ragtown series: Very deep, moderately well drained soils formed in moderately fine and fine-textured lacustrine materials, also from mixed rock sources. This soil is commonly found on lake plain terraces with slopes from 0 to 4 percent.

4.5.2 Needs Assessment

Need: Proper and accurate mapping of soils is critical for management of natural resources.

Assessment: Although most of the soils have been mapped for NAFB, information is still lacking on some of the more remote areas on the east side of the Base in Area II. Soils on NTTR have not been mapped to any appreciable extent across the entire area. Mapping of soils on NTTR should be a high priority because of its importance in enabling the natural resource manager to locate vegetative communities, to identify potential areas capable of supporting species of concern, and to predict recovery for impacted areas. In addition, accurate maps placed in a GIS modeling program will allow project managers and planners to detect and avoid sensitive areas during the early stages of project planning.

In summary, the following are critical needs for NTTR and NAFB for soils resource management:

- Map soils in Area II at NAFB.
- Map soils at the Small Arms Range.
- Map soil mapping units in South Range and in areas of the North Range that have not been mapped by BLM and NRCS.
- Incorporate soil maps and data into the natural resource database for use in project planning and modeling of sensitive areas.

4.5.3 Management Goals within the Mission

GOAL 1: Develop accurate soil maps for NTTR and NAFB to the mapping unit level of detail.

GOAL 2: Develop a GIS database model to depict areas sensitive to development and impacts from mission projects.

4.5.4 Management Guidelines

The military mission always takes precedence over the guidelines recommended in the INRMP. Managers should adhere to the guidelines within the constraints of the mission.

During the early planning process for any project, the following steps should be taken to ensure that soils are protected:

- **Using the natural resource database and available data, determine the soils that are present on the site and potential limitations or problems associated with those soils. As the natural resource database is further developed, these limitations will be provided in mapping format to allow for easy access and determination of potential problems in the project area.**
- **Using the GIS soil maps, identify any areas that may be sensitive to impacts by the project. These may include soils that are capable of supporting endangered species and other species of concern.**
- **Using field observations and soil maps, assess erosion conditions and use best management practices to reduce erosion and sedimentation during construction projects. This is especially critical along and around ephemeral streams and drains, as well as watershed areas.**
- **Rapidly re-establish vegetation as soon as possible to avoid potential problems with blowing dust and water erosion.**
- **If a mission activity requires excavation, the top 6-12 inches of soils should be removed and stockpiled separate from any deeper soils where practical. Upon completion of the action, the stockpiled soil should be spread as a final layer over any exposed areas (not covered by facilities or impermeable surfaces).**
- **Landscaping on soils should be restricted to native plants that are adapted to the soils on the site. Plants requiring extensive use of irrigation and addition of soil amenities should be avoided.**

4.5.5 Projects

Project	Goal	Project No.	Due Date
1. Complete mapping of soils in Area II at NAFB, the Small Arms Range, and any other portions of the NAFB that have not been mapped.	1	New: Vegetation/Soils/Geologic Surveys	June 2007
2. BLM is responsible for the soil mapping on the NTTR North Range and a small portion of the South Range. Consult with BLM to identify areas in the North Range that are scheduled for mapping by BLM and incorporate data into the natural resource database.	1	Range, GIS Database & Aerial Photography	December 2007
3. Map and delineate soils on NTTR to the mapping unit level of detail using current geologic maps, aerial photography and limited ground-truth data. This will be a relatively large project and should be completed in conjunction with the mapping of geologic formations. A qualified geologist and soil scientist should be used for this project. Geology and vegetation will be mapped in conjunction with this project. In the time frame of this INRMP, the following areas should be mapped and incorporated into GIS:			
a. Range 62S and 62N	1,2	New: Vegetation/Soils/Geologic Surveys	Dec. 2008
b. Range 63	1,2	New: Vegetation/Soils/Geologic Surveys	Dec. 2009
c. Range 65S and 65N	1,2	New: Vegetation/Soils/Geologic Surveys	Dec. 2010
d. Range 64A and 64B	1,2	New: Vegetation/Soils/Geologic Surveys	Dec. 2011
e. Range 64C and 64D	1,2	New: Vegetation/Soils/Geologic Surveys	Dec. 2012
e. Range 71N and 71S	1,2	New: Vegetation/Soils/Geologic Surveys	Dec. 2013
4. Data collected from the field soil studies should be incorporated into the natural resource database as it is available.	2	Range, GIS Database & Aerial Photography	Annual

4.5.6 References

Literature Cited

EG&G Energy Measurements. 1991. The Distribution and Abundance of Desert Tortoises. 3.

Nevada Environmental Consultants, Inc. 1998. Biological Assessment: Bureau of Land Management Lands Selected for Withdrawal. Nellis Air Force Base. 5.

Nevada Environmental Consultants, Inc. 1999. Environmental Assessment: Volkmar Land Exchange Proposal and Nellis Air Force Base Withdrawal. 15.

Nicoletti, Mary Jo. 1991. Mojave Desert Tortoise Survey at Range 63. Nellis AFB, Nevada.

Speck, R.L. 1985. Soil Survey of Las Vegas Valley Area, Nevada, Part of Clark County. United States Department of Agriculture, Soil Conservation Service.

U.S. Department of the Air Force. 1997. Bird Survey Report. Nellis Air Force Base/Range. 2-3 – 2-11.

U.S. Department of the Air Force. 1999. Renewal of the Nellis Air Force Range Land Withdrawal. Legislative Environmental Impact Statement. Volume 1.

U.S. Department of the Interior. 1991. Nellis Air Force Range Resource Plan and Record of Decision. 13.

Additional References

Nellis Air Force Base. 2002. Draft Environmental Baseline Study: Nellis Terrace Housing Area. Nellis Air Force Base, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Water Wells Annex. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Manch Manor Housing Area. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Dunning Circle Housing Area. Nellis AFB, Nevada.

Nellis Air Force Base. 1997. Bird Survey Report. Air Force Project No. RKXF956145. Nellis AFB and Nellis Air Force Range, Nevada.

Nevada Environmental Consultants, Inc. 1998. Biological Assessment: Bureau of Land Management Lands Selected for Withdrawal. Nellis Air Force Base, Nevada.

United States Department of the Air Force. 1994. Final Report of Fall and Winter Surveys for Nine Wildlife Species on Nellis Air Force Base Area II. Nellis Air Force Base, Nevada.

United States Department of Defense Legacy Resource Management Program. 1997. An Inventory of 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, Part A: The Inventory.

U.S. Army Corps of Engineers, Omaha District. 2001. Environmental Assessment: Live Ordnance Departure Area (LODA) at Nellis Air Force Base. Prepared for Environmental Management Office, 99th CES, Nellis AFB, Nevada.

4.6 WATER RESOURCES

4.6.1 Surface Waters

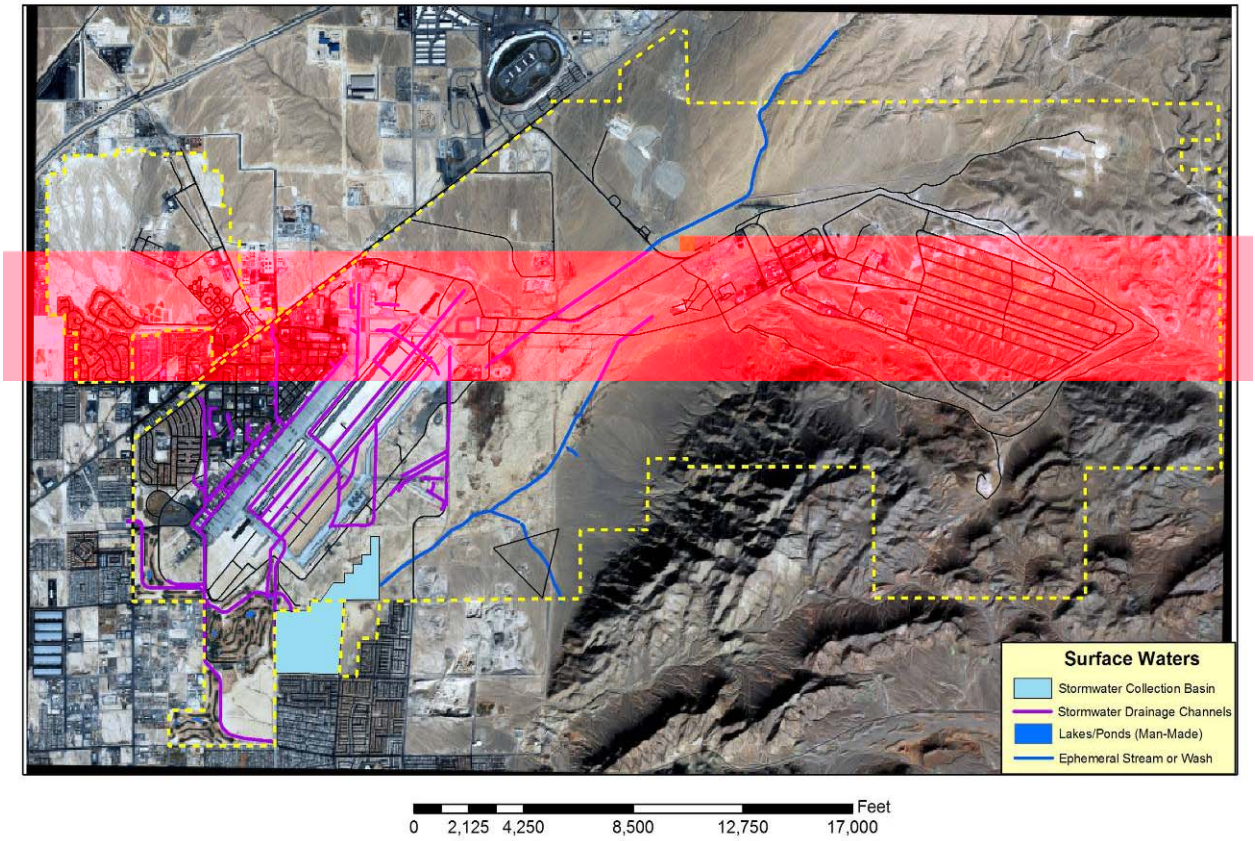
4.6.1.1 Description of Current Conditions

4.6.1.1.1 NAFB

NAFB is located in the northern portion of the Las Vegas Valley, which extends in a northwest to southeast direction and drains through the Las Vegas Wash into Lake Mead. No natural peren-

Figure 4-9. Surface waters found on NAFB.

Source: NAFB Civil Engineering



nial or intermittent streams, lakes, or springs are found on NAFB due to the low precipitation, high evaporation rates and low humidity (USACE, 2001). All impoundments are man-made and located on the golf course. Water erosion is rare in the basin, but can be somewhat prominent along alluvial fans. This is especially evident in Area II along the base of Sunrise Mountain.

The site contains several ephemeral streams or washes that eventually flow into Las Vegas Wash. Figure 4-9 shows the major washes and other surface waters found at NAFB.

Area I of NAFB is an urban environment that contains aircraft facilities, including runways, residences, offices, and recreational facilities. Ponds have been established on the NAFB golf course, but are probably not jurisdictional waters because they are isolated and supplied by artificial sources of hydrology. Stormwater in all areas of NAFB generally flows to Clark County Regional Flood Control District channels to the southeast where it is routed into the Las Vegas Wash. Municipal sewage from NAFB is treated by the Clark County Sanitation District in a modern facility and then released into Las Vegas Wash southeast of the Valley. Las Vegas Wash is historically connected directly to the Colorado River. As of March 2003, it follows its historic channel for most of its course, but near the Lake Mead National Recreation Area it is channeled below Lake Las Vegas, the center of a private home and golf course development. After emerging from beneath the Lake, Las Vegas Wash flows approximately one kilometer before emptying into Lake Mead. Because Las Vegas Wash is connected to the Colorado River, any ephemeral streams and washes eventually emptying into the Las Vegas Wash could potentially be considered jurisdictional under Section 404 of the Clean Water Act. This means that any action that results in the placement of fill in those streams would require coordination with the USACE.

Area II of NAFB is largely undeveloped, but houses the Red Horse Squadron, EOD, a munitions storage area, and the Federal Prison Facility. These facilities are also connected to the municipal sewage system. Runoff from the undeveloped desert areas north and east of NAFB during infrequent storm events drains into the Las Vegas Wash to the southeast, which eventually drains into Lake Mead (Colorado River). Area III of NAFB, supporting residential areas, the Hospital, and gasoline storage tanks, is also connected to the municipal sewage system. The Small Arms Range also contains many ephemeral streams, alluvial fans, and draws, all of which are potentially jurisdictional waters of the U.S. because of their eventual connection with the Colorado River.

4.6.1.1.2 NTTR

Similar to NAFB, NTTR is located in a semi-arid to arid region with very few surface water resources and groundwater many hundreds of feet below the surface. Currently, 97 springs and other surface waters have been identified at NTTR (Figure 4-10). These waters are essential for the maintenance of terrestrial wildlife populations. In addition, many of the seeps and springs have developed micro-ecosystems that support a wide variety of plants and animals uniquely adapted to isolated surface waters in desert regions.

Average annual precipitation at NTTR has been previously discussed and ranges from four inches on the desert floor to about sixteen inches in mountain areas. Although some thunderstorms are sufficiently intense to produce flash flooding, most summer precipitation is lost to evaporation a short time following storm events. However, winter precipitation often forms snow packs in the high mountains. These snow packs store sufficient moisture to allow runoff to overcome high rates of evaporation and transpiration in the warm summer months. Melting snow often provides some water for drainages and riparian corridors in the early spring.

NTTR is located within the Great Basin region of the U.S., which is characterized by internally drained basins. The southern portion of Range 63 drains into the Las Vegas Valley and eventually into Las Vegas Wash. In addition, Range EC South and parts of the Nevada Test Site

drain into the Amargosa River. Most of the surface water drains internally into many playas found throughout the area. In the playas, water collects and then eventually evaporates, leaving behind high concentrations of salts and other materials that often cause playas to be void of vegetation. Under current regulations of the USACE, playas and their associated drainages are no longer jurisdictional waters because they are isolated and not connected to waters of the U.S. Thus, consultation with the USACE under Section 404 is not required if the actions place fill material in isolated waters of the U.S. such as playas.

Most of the surface waters at NTTR are ephemeral and exist only in dry washes and on playa surfaces for a few hours following summer storms and possibly a few weeks following winter storms. Very few surface waters and streams would be considered intermittent or perennial due to the fact that their source of water is surface water runoff and not groundwater. With the exception of Breen Creek, NTTR has no permanent streams. Figure 4-11 shows the different watershed areas found in NTTR. Most of these watersheds are basins with internal flow only.

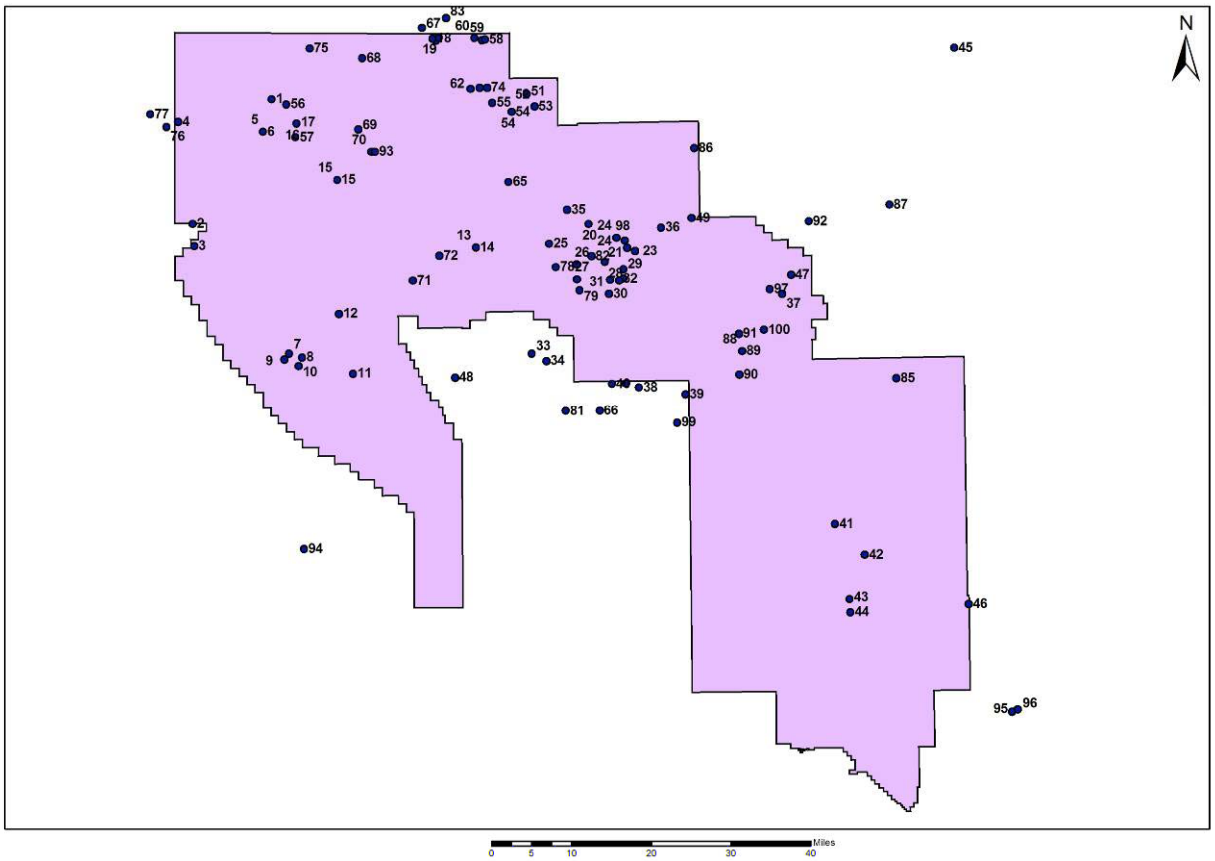
With the exception of some manmade ponds, dugouts, and guzzlers, the only perennial surface waters originate from springs, which either form pools or flow for short stretches across the ground surface. Dugouts are usually located in areas that were excavated in the past to accumulate surface water for livestock.

Spring located on the Kawich Range supports unique habitat for wildlife such as the pygmy rabbit.

Information on surface water quality is collected annually by the USAF, USGS, and DoE. A recent investigation on surface soils following the bombing of targets was conducted to determine if practice bombing activities cause surficial soil contamination (NAFB, 1996). The results of this study indicated that some contamination occurred at target sites, but the concentration of contaminants was relatively low, and there was little or no risk to people and the environment. Precipitation would tend to transport and disperse these soil contaminants under normal circumstances. However, most target areas are located in basins with no connections to surface waters outside of the basin. Thus, any contamination moved by surface waters would remain in playa lakes and valley bottoms. At these locations, most contaminants would be immobilized by the high level of clays found in the playa lakes (quoted from NAFB, 1999, Page 3.6-7).

Only two areas at NTTR fall under the requirements for NPDES permitting. These include TTR and CREECH AFB and allow for discharge of storm water in accordance to general permit number GNV00022233.

Figure 4-10. Springs and other surface waters found on NTTR.



SURFACE WATER	NUMBER	SURFACE WATER	NUMBER	SURFACE WATER	NUMBER
Unnamed Seep	1	Johnnie's Spring	32	White Rock Spring	66
Stonewall Spring	2	Black Rock Spring	33	Stinking Springs	67
Jerome Spring	3	Kihibab Spring	34	Fork Spring	68
Wildhorse Spring	4	Antelope Reservoir	35	N. Antelope Reservoir	69
Alkali Spring	5	Chalk Spring	36	Antelope Reservoir	70
Alkali Spring	6	Rock Spring	37	Nixon #1	71
Monte Cristo Spring	7	Tub Spring	38	Nixon #2	72
Rock Spring	8	Cane Spring	39	Tunnel Spring	73
Trappman Spring	9	Wire Grass Spring	40	Corral Spring	74
Tule George Spring	10	Quartz Spring	41	Reservoir #2	75
Pillar Spring	11	Indian Spring/Canyon	42	Cane Spring	76
Larry's Seep	12	Tim Spring	43	Tognoni Spring	77
Jackpot Reservoir	13	Sand Spring	44	Sundown Reservoir	78
Unknown	14	Shale Cut Spring	45	Shirley Spring	79
Antelope Spring	15	White Rock Spring	46	Indian Spring	80
Cactus Spring	16	Quail Spring	47	Live Oak Spring	81
Cactus Spring	17	Summit Spring Drainage	48	Pony Spring	82
Silverbow Spring	18	Beck Spring	49	Silverbow Canyon	83
Silverbow Creek	19	Summer Spring	50	Cresent Valley Res #2	85
Coyote Pond	20	Summer Spring	51	Pink Hills Reservoir	86
Horse Spring	21	Cedar Spring	52	Tule Spring	87
Unnamed Spring	22	Cedar Spring	53	Miners Spring	88
Unnamed Spring	23	Rose Spring	54	Disappointment Spring	89
Cliff Spring	24	Log Spring	55	Belted Reservoir #2	90
Kawich Tank	25	Stealth Seep	56	Naquinta Reservoir #1	91
Lamb's Pond	26	Urania Mine Seep	57	Indian Spring	92
Unnamed Drainage	27	Phantom Spring	58	Cattle Spring	97
Wildcat Spring	28	Sandeen Spring	59	Cliff Spring	98
Gold Spring	29	Thunderbird Spring	60	Reservoir #4	99
Indian Spring	30	Coral Spring	62	Cane Spring	100
Indian Spring	31	Granite Spring	65	Oak Springs	101
Johnnie's Water	32				

Tan Shading: Springs or seeps

Green shading: Dugouts or manmade reservoirs

According to the EIS prepared for the floodplain analysis (USAF, 1997), surface waters found in NTTR characteristically show three different watershed features:

- Alluvial fans
- Valley collectors
- Dry lake beds or playa lakes

Alluvial fans are found at the base of mountains where flooding is characterized by high-velocity flows, active processes of erosion, sediment transport and deposition, and flow paths are unpredictable. Alluvial fans are different from normal stream channels in that flooding in the upper portion of the alluvial fan is confined to a single channel that disperses into multiple channels as it flows down gradient. Conventional stream channels tend to coalesce into larger channels as they move down gradient. Further down slope from the mountain front, the alluvial fans join and coalesce. When the longitudinal slope decreases, shallow flooding may occur.

At the bottom of alluvial fan systems, a single channel often establishes. This channel is termed a "valley collector." The valley collector collects and transmits the flow from several systems of alluvial fans to a topographic outlet connected to other waters of the U.S., or to a playa lake when no outlet is present. Valley collectors are important features within the NTTR ecosystem. Even though these features are dry for a significant portion of the year, they tend to support higher densities of vegetation along and near the banks. This vegetation is supported because of the presence of higher levels of moisture that last for longer periods of time following precipitation. The dense vegetation provides food and cover for various wildlife species.

Dry lakebeds are typically located at the lowest elevation compared to the surrounding watersheds. During or immediately following storm events, these dry lakebeds receive water, either from direct precipitation on the lakebed, or from valley channels that drain surrounding upland areas. Dry lakebeds tend to hold water for short periods of time following precipitation events. Water flowing into the lakebeds contains sediments and dissolved solids. Sediments spread evenly over the lake's surface, creating the flat topography commonly associated with these lakebeds. As water evaporates, dissolved solids are deposited on top of the sediments. This results in a barren terrestrial surface that does not support vegetation. Although lakebeds do not support significant populations of vegetation, they have been shown to be important to migratory birds after significant precipitation has occurred, because they provide food sources such as brine shrimp, insects, and other invertebrates.

4.6.1.2 Needs Assessment

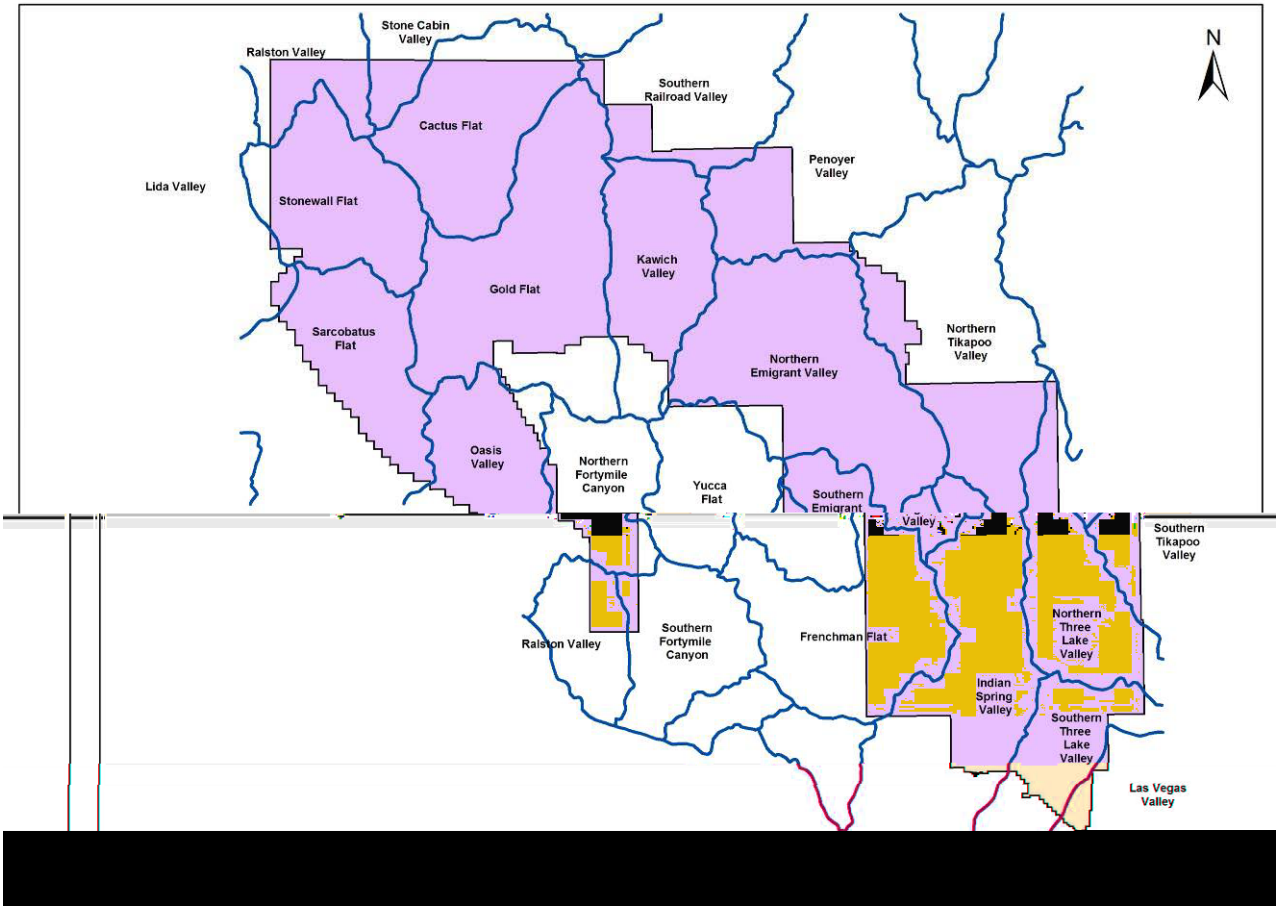
Need: Ephemeral streams and washes have not been mapped at NTTR or NAFB. These streams support riparian vegetation which is often unique habitat potentially supporting species of concern. Early identification of these sensitive areas can prevent unnecessary delays to mission activities caused by consultation with USFWS and other federal agencies.

Assessment: Most, if not all, springs found in NTTR have been identified and mapped. A great deal of these springs are associated with wetlands and are discussed in a wetland survey conducted in 1997 (Dames and Moore, 1997). However, maps of major ephemeral streams and washes have not been prepared for the area. In addition, flora and fauna associated with springs have not been surveyed or characterized since 1997. This information is very important in the project planning to minimize impacts to surface water and to prevent damage to projects caused by surface water flows.

Need: Surface water quality has not been determined or monitored at NTTR.

Assessment: With respect to water quality, few studies have been conducted to monitor surface water runoff originating from areas impacted by mission operations, including bombing targets. Some information on the general quality of water collecting in playa lakes has been collected for some areas at NTTR and should be incorporated into the natural resources database. DoE has prepared a database which delineates the quality of surface and groundwater in selected springs, seeps, and wells on NTTR, and this information is provided to NTTR annually. Water quality data is critical in characterizing the overall health of the ecosystem at NTTR. Most importantly, this monitoring provides a natural barometer for identifying impacts to groundwater and surface water potentially caused by mission activities. Because water is so scarce on

Figure 4-11. Watersheds or hydrologic units found on NTTR as designeated by the USGS



NTTR, the quality is extremely important for support of healthy plant and animal populations. Water samples should be collected from major points across NTTR at least annually and monitored for change. If water quality shows degradation then additional research to determine the cause would be warranted. This task could be a responsibility shared between CEVN or CEVC. As a minimum these samples should be analyzed for RCRA metals and any other potential contaminants that might be associated with explosives.

4.6.1.3 Management Goals within the Mission

GOAL 1: Avoid or minimize impacts to ephemeral streams, washes, and drainage channels located in NTTR.

GOAL 2: Annually monitor the water collecting in playa lakes or flowing through basin outlets to monitor freshwater quality and quantity.

GOAL 3: Monitor the quality of water flowing from natural springs on NTTR to ensure that spring water is not degraded by any activities of the Air Force at NTTR.

GOAL 4: Incorporate the surface water data into the natural resource database for use in resource management and planning.

4.6.1.4 Management Guidelines

The military mission always takes precedence over the guidelines recommended in the INRMP. Managers should adhere to the guidelines within the constraints of the mission.

During construction projects and any other activities that would result in removal of vegetation or disturbance to the soil surface, the following actions should be taken to conserve surface waters:

- **Where practical, Best Management Practices, such as hay bales and silt fences, should be used to minimize soil erosion and deposition of sediments in ephemeral streams, collection valleys, and playa lakes.**
- **The natural resource manager should be consulted before any action is taken that may impact streams, washes, or playas. The action may require consultation with the USACE if it places fill material in ephemeral streams, wetlands, or other surface waters connected to waters of the U.S. Ephemeral streams include any natural drain that has a defined channel or shows features characteristic of flowing water. Streams flowing into playa lakes and other isolated basins are not jurisdictional because they are not connected to waters of the U.S. and would not require consultation with the USACE. However, the natural resource manager should be consulted to make the final determination of whether or not the USACE should be contacted.**
- **Actions that impact vegetation along streams, washes, or springs should be modified where possible to avoid or minimize impacts.**
- **Whenever possible, roads, pipelines, and any other linear construction projects located within fifty feet of any stream channel or drain should not be oriented parallel to the stream channel because of the potential for erosion and eventual damage to the pipeline or road.**
- **Roads and pipelines crossing over streams should be oriented perpendicular or near-perpendicular to the stream channel.**

Mission maintenance and operation activities should consider the following prior to initiation:

- **Direct or indirect impacts to springs and associated wetlands or vegetational communities should be avoided whenever possible.**
- **Impacts to streams and drains should be minimized.**
- **Any actions resulting in the deposition of fill material in ephemeral streams should be reported to the natural resource manager who will determine if coordination with the USACE is required.**

4.6.1.5 Projects

Project	Goal	Project No.	Due Date
1. Summarize and map information collected in past studies concerning surface waters and their characteristics. A standard procedure should be developed for uniform entry of data into the GIS database.	4	Range, Survey-Monitor-Maintain, Wetlands/Seeps/Springs	June 2007
2. Delineate and map ephemeral streams and washes at NAFB and NTTR for proposed mission projects.	1,4	Range, Survey-Monitor-Maintain, Wetlands/Seeps/Springs	Annual
3. Surface water data should be incorporated into the natural resource database. This will assist planners in avoiding impacts to jurisdictional surface waters that may require permitting with the USACE.	1,4	Range, GIS Database and Aerial Photography	Annual
4. Evaluate and delineate wetlands associated with springs and seeps in NTTR. Monitor the quality of the water in the springs and wetlands. Vegetation and wildlife populations supported by these areas should be characterized and monitored. Each site should be delineated according to USACE guidelines.	2,3	Range, Survey-Monitor-Maintain, Wetlands/Seeps/Springs	Annual

4.6.1.6 References

Literature Cited

Dames and Moore. 1997. Nellis Air Force Range Wetlands Survey Report.

NAFB. 1996. Contamination Report for the Nellis Air Force Range Land Withdrawal Environmental Impact Statement. Las Vegas, Nevada.

NAFB. 1999. Renewel of the Nellis Air Force Range Land Withdrawal. Department of the Air Force Environmental Impact Statement.

USACE. 2001. Environmental Assessment: Live Ordnance Departure Area (LODA) at Nellis Air Force Base. Prepared for Environmental Management Office, 99 CES, Nellis AFB, Nevada.

USAF. 1997. Final Floodplain Inventory Report. NTTR.

Additional References

Nature Conservancy. 2000. Ecoregion-Based Conservation in the Mojave Desert with a Contextual Analysis for Nellis Air Force Base and Ranges: Volumes I and II.

Nellis Air Force Base. 2002. Draft Environmental Baseline Study: Nellis Terrace Housing Area. Nellis Air Force Base, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Manch Manor Housing Area. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Dunning Circle Housing Area. Nellis AFB, Nevada.

4.6.2 Groundwater

4.6.2.1 Description of Current Conditions

4.6.2.1.1 NAFB

NAFB is located on the eastern side of Las Vegas Valley, an intermountain basin within the Basin and Range Province of the United States. Groundwater flow within Las Vegas Valley is generally from west to east. The valley-fill sediments of the Las Vegas basin are host to a large groundwater reservoir. Groundwater currently accounts for about 29% of the water supply for NAFB. The deeper aquifers at NAFB are not known to have been impacted by contaminants identified in shallow groundwater. Laboratory analyses of samples from six Nellis AFB production wells detected no contamination by VOCs or nitrates. The contaminants in the shallow groundwater are being reduced by a remediation system.

4.6.2.1.2 NTTR

NTTR is located within the carbonate-rock province of the Great Basin (Prudic et al., 1993). This province extends across much of eastern and southern Nevada and western Utah and, because of the permeability of carbonate rocks, supports an extensive, regional groundwater flow system. Groundwater within the carbonate-rock province has been conceptualized as occurring within two interconnected aquifer systems: a regional system that is largely within deeply buried carbonate bedrock, and additional shallow alluvial aquifer systems which are more local in extent and which reside in individual basins or watersheds. Recharge to these aquifer systems comes mainly from the infiltration of winter precipitation that falls on the mountains within the province. Groundwater discharge occurs primarily through evapotranspiration from the valley floors and from spring discharge at large springs.

Much of the measurable groundwater flow within the carbonate rock is relatively shallow and is confined to individual mountain-valley watersheds. The direction of flow in these shallow aquifer systems does not necessarily coincide with flow in the deeper, regional groundwater system, which crosses individual mountain ranges. In general, deep groundwater flow within NTTR is believed to be to the southwest; however, there are only a few wells that could be used to confirm groundwater levels or gradients. Flows in the local aquifer systems are believed to follow surface drainages in most cases. Groundwater is, therefore, expected to move from the surrounding highlands toward the topographic low point within an individual valley or basin.

Several regional groundwater flow systems have been identified in the Great Basin (Harrill et al., 1988). Many of the target complex sites on NTTR are located within the Death Valley regional flow system. The Death Valley flow system is composed of fractured carbonate and volcanic rock and is characterized by interbasinal flow toward the west and southwest, where discharge

occurs at several large regional springs. The Death Valley playa in California is considered to be the terminus of this regional flow system.

The Death Valley flow system has been further divided into smaller hydrographic basins, which possess distinct recharge areas (Harrill et al., 1988). These areas contain valley-fill groundwater reservoirs recharged mainly by snowmelt on the adjacent mountains. Precipitation that falls on the valley floors is largely lost to evaporation and evapotranspiration, and provides little recharge to the groundwater systems.

Water quality information is largely limited to regional data on dissolved solids concentrations and the dominant chemical type (Thompson and Chappell, 1984). Generally, the groundwater within the North Range has dissolved solids concentrations that do not exceed 500 mg/L. This groundwater is rich in sodium bicarbonate. Groundwater in the South Range has dissolved solids concentrations, which typically vary from 500 to 1,000 mg/L, and is rich in calcium/magnesium bicarbonate.

The amount of groundwater recharge in mountains in and adjacent to NTTR depends upon precipitation, evapotranspiration, permeability of the surface soils, and vegetation. The greatest opportunity for groundwater recharge is in areas of permeable surface materials during periods when precipitation is in excess of evapotranspiration. However, because evaporation usually exceeds precipitation at rates from -50 to -65 inches annually on NTTR (HAZWRAP PA, 1992), the amount of recharge on valley floors to the groundwater is generally limited.

Well records from the Nevada Division of Water Resources indicate that there are nine permitted water-supply wells on NTTR (Roe, 1998). In addition to these permitted wells, there are wells on NTTR that are used for testing and hydrogeological research projects associated with the Nevada Test Site and other DOE projects. The only known wells within active bombing targets are on Range 75 in southern Gold Flat and on Range 63.

4.6.2.2 Needs Assessment

Need: Need: DOE is assessing pototWater quisi6(oundr Dduc divisually)1 Tf2.2514 -1.153 TD30.0011 Tc0.0654m a

4.6.2.4 Management Guidelines

The military mission always takes precedence over the guidelines recommended in the INRMP. Managers should adhere to the guidelines within the constraints of the mission.

During the planning or initiating of any mission activity or project, the following steps should be taken:

- **Identify any sensitive recharge features potentially impacted by the action. If at all possible, impacts to these features should be avoided or at least minimized. All efforts should be made to prevent any contamination to ground water in the area.**
- **Mission actions involving exploding ordnances or potentially hazardous materials should not occur within 200 feet of any production well, monitoring well, or natural spring.**

4.6.2.5 Projects

Project	Goal	Project No.	Due Date
1. During geologic assessments, recharge features should be identified and mapped.	1	New: Vegetation/ Soils/Geologic Surveys	Annual
2. Information on the location and sensitivity of recharge zones should be incorporated in to the natural resource database to allow for project planners to avoid or minimize impacts to those features.	2	Range, GIS Database and Aerial Photography	June 2007
3. Incorporate groundwater and spring water quality data into the GIS database and update that information annually.	2	Range, GIS Database and Aerial Photography	Annual

4.6.2.6 References

Literature Cited

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. Geologic Survey, Hydrologic Investigations Atlas HA-694-B.

Hazardous Waste Remedial Action Program (HAZWRAP). 1992. *Preliminary assessment of the Nellis Air Force Range*. U.S. Air Force - Tactical Air Command.

Prudic, D. E. 1993. *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 Open-File Report 93-170.

Roe, J. 1996. Nellis Air Force Base Environmental Management Directorate, Restoration Division. Personal communication.

Thompson, T. C. and R. Chappell. 1984. *Maps showing distribution of dissolved solids and dominant chemical type in groundwater, Basin and Range Province, Nevada*. U.S. Geologic Survey, Water-Resources Investigations Report 84-4119-C.

Additional References

Bechtel Nevada Ecological Services. 1999. Ecological Monitoring and Compliance Program: FY 1999 Report. Las Vegas, Nevada.

Department of the Air Force. 1999. Renewal of the Nellis Air Force Range Land Withdrawal Legislative Environmental Impact Statement. Nellis AFB, Nevada.

Nature Conservancy. 2000. Ecoregion-Based Conservation in the Mojave Desert with a Contextual Analysis for Nellis Air Force Base and Ranges: Volumes I and II.

Nellis Air Force Base. 2002. Draft Environmental Baseline Study: Nellis Terrace Housing Area. Nellis Air Force Base, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Manch Manor Housing Area. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Dunning Circle Housing Area. Nellis AFB, Nevada.

4.6.3 Wetlands

4.6.3.1 Description of Current Conditions

NAFB

Recent field surveys to assess wetland occurrence have been conducted at NAFB, and 1:250,000 scale National Wetlands Inventory (NWI) maps have been prepared by USFWS. The NAFB, South Range, and portions of the North Range are included on these NWI maps. Map coverage at the 1:24,000 scale is not available. It is important to note that these maps only show potential wetlands and surface waters based on aerial photography and little or no ground truth data. Acquiring more detailed information will facilitate compliance with the Clean Water Act.

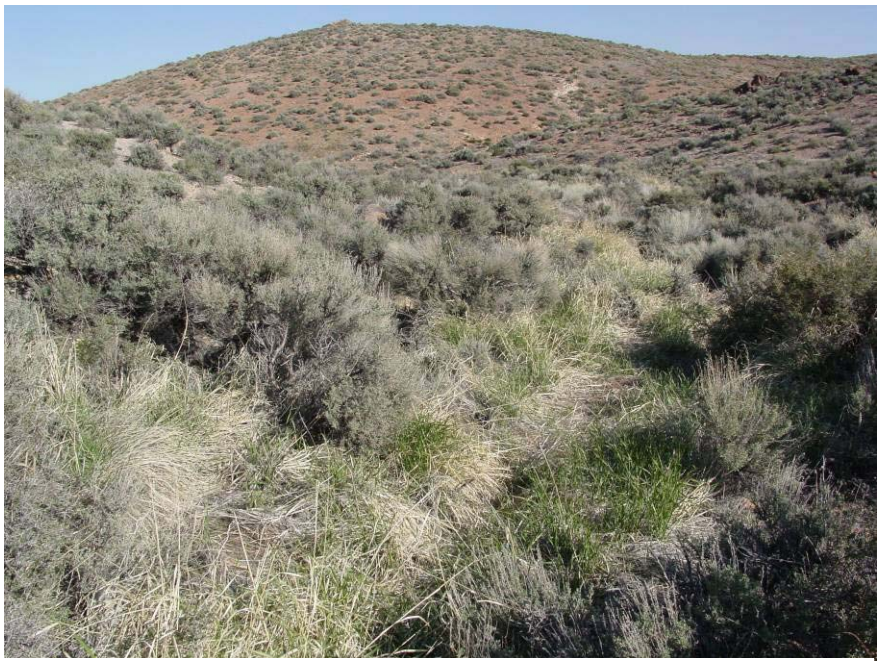
The only potential wetlands on NAFB are the golf course ponds (NAFB 2002). The NAFB natural resource specialist requested guidance regarding the wetlands status of these man-made water sources from Mr. Kevin Roukey of the U.S. Army Corps of Engineers, Sacramento District, Nevada State Office. Mr. Roukey indicated that the golf course ponds are not subject to wetlands protection under the provisions of the Clean Water Act because they are man-made and the water source is treated groundwater. The remainder of NAFB is arid scrub land or urban with no wetlands.

NTTR

A surface water survey was conducted in 1996 to characterize, describe, catalog, and delimit the extent of water resources within the NTTR (Dames and Moore, 1997). The survey focused on seeps, springs, ponds, and one creek. Current conditions of these water resources were characterized in terms of surface water, saturated soils, and value to wildlife, with a goal of identifying potential jurisdictional wetlands rather than conducting formal wetland delineations according to the methodology specified in the 1987 USACE *Wetland Delineation Manual* (Wetlands Training Institute, Inc., 1995). The functional definition used in the surveys was as follows:

> *"The term 'wetlands' will be interpreted to mean those areas that are permanently or seasonally inundated and/or saturated to the ground surface for a duration that promotes the establishment of hydrophytes (wetland plants) under normal circumstances."*

Sixty-five locations were visited to determine the presence or absence of potential wetlands. The lack of soil inventories available from NRCS, as well as obvious impacts by humans and wild horses, required Natural Resources staff to conduct case-by-case evaluations for each site. In a November 8, 1996 letter to 99th CES, the USACE agreed with the assessments, and a copy of the jurisdictional letter is included with the 1997 report (NAFB, 1997). After the 1996 USACE letter and the 1997 report, the definition of jurisdictional wetlands was narrowed somewhat by the U.S. Supreme Court in *Solid Waste Agency of Northern Cook County v. U.S. Army Corps of Engineers* (SWANCC), 531 U.S. 159 (2001). The INRMP includes consideration of jurisdictional wetlands as defined by the SWANCC case and subsequent court decisions, to the effect that isolated, non-navigable, intrastate waters, with no connection to navigable waters, are not jurisdictional wetlands. Because of the limited extent of wetlands, it is not anticipated that the NTTR will be eligible to participate in wetlands banking programs.



Wetlands are often associated with seeps and springs as this wetland area located on the North Range.

Although somewhat limited, surface waters on the North Range are more extensive than on the South Range. Four construction water ponds and numerous smaller historic dugouts constructed in the past by ranchers are present on the North Range. Surface waters are extremely limited on the South Range. The largest water body in the area is 300 ft south of Range 65 South, the sewage treatment pond for the town of Indian Springs. Though the pond is technically off NTTR, the sewage treatment ponds are an important regional resource for wildlife, particularly

birds and bats. Because this source is off NTTR and ponds used for sewage treatment are not considered jurisdictional, it will not be addressed further in this report.

Fencing protecting a wetland/spring from wild horse grazing in the Cactus Range.

The limited surface water resources of the NTTR are unlikely to be designated as waters of the United States by the USACE due to the fact that most of them are part of closed basin watersheds and not connected to navigable waters of the U.S. However, washes and arroyos on the NTTR in areas proposed for disturbance should be surveyed and assessed to determine if they have a discernable ordinary high water mark or meet wetland criteria and if they are connected to navigable waters of the U.S. Consultation with the USACE should be initiated if these criteria are met.

4.6.3.2 Needs Assessment

Need: Current data on the condition and jurisdictional status of wetlands on NTTR is not available. In addition, wetlands have not been formally delineated using USACE criteria and GPS surveying.

Assessment: Wetlands and other water source areas are restricted environments in the arid deserts. They are critical for many wildlife species and often support unique floral communities. The wetland survey conducted by Dames and Moore in 1997 appears to have identified many of the wetlands located on NTTR. However, this survey was conducted in 1996, and many changes in the environment may have occurred since that time. In addition, impacts caused by wild horse grazing have resulted in the degradation of several wetlands on NTTR. The boundaries of the wetlands assessed in the 1996 study are only estimates, and they are no longer valid. The USACE accepts wetland determinations and delineations for no more than a five-year period and now require delineation using GPS equipment with sub-meter accuracy. The USACE, however, concurred with the conclusions of the Wetlands Report that many of the Range's water sources are potential jurisdictional wetlands. However, recently, isolated wetlands not connected to navigable waters of the U.S. were determined to not be within the jurisdiction of the USACE. Because much of NTTR lies in closed basins, many of these wetlands will probably not be jurisdictional since they are not connected to navigable waters.

Need: Coordinate with resource agencies to provide additional conservation of wetland plant communities by management of the wild horse herds on NTTR in a manner to minimize or avoid degradation of plant communities and encourage biodiversity.

Assessment: Wild horses and burros cause disturbance to NTTR wetland areas through vegetation foraging and trampling. The BLM has jurisdiction over these animals, but BLM has few resources for water source protection, restoration, or development. Therefore, the development of a program to conserve spring sources and surrounding wetlands is necessary. The Water

Resources Program (WRP) was initiated to include fencing sensitive spring and wetlands habitat to make them inaccessible to horses, but not to wildlife. The program takes into account the needs of an agreed-upon number of horses on the NWHR by making water available at selected locations. Management partners, including NAFB, BLM, NDOW, and USFWS have determined that the appropriate carrying capacity of the Wild Horse Management Area of NTTR is 300 – 500 animals. This is the maximum number of horses that the available resources will support without undue negative impacts to other species. The program needs to be continued and enhanced and supported.

Need: Data collected from the 1996 wetland studies have not been incorporated into an environmental or natural resource database.

Assessment: Electronic files should be obtained from Dames and Moore and incorporated into the natural resource database as soon as possible. These files could then be updated using new data collected on those wetlands and adding any new wetlands to the database. These studies were only initial assessments, and more definitive delineations should be conducted.

4.6.3.3 Management Goals within the Mission

GOAL 1: Because wetlands are a rare commodity on NTTR and NAFB, any actions planned or designed for the mission should avoid and minimize impacts to wetland areas.

GOAL 2: Develop and maintain an up-to-date GIS database providing information on the quality, characteristics, and locations of wetlands found on NTTR and NAFB.

4.6.3.4 Management Guidelines

The military mission always takes precedence over the guidelines recommended in the INRMP. Managers should adhere to the guidelines within the constraints of the mission.

During the early planning and design phases of any mission project or action, the following steps should be taken to ensure the conservation of wetland areas:

- **Project managers should review the natural resource database to determine if any wetlands have been identified in the area of the proposed action.**
- **If wetlands are found to be impacted by the action, if at all possible, an alternative site should be selected for the project that avoids impacts to wetlands. If impacts cannot be avoided, methods of modifying the project to minimize impacts to wetlands should be considered.**
- **For projects that directly or indirectly impact wetlands, the following should be accomplished:**
    1. **The boundaries of the wetlands should be delineated to obtain an accurate estimate of the area of wetlands that will be filled by the project.**
    2. **The natural resource manager should determine if the wetland is potentially jurisdictional. If the wetland is found to be potentially jurisdictional, the natural resource manager should coordinate permit preparation with the U.S. Army Corps of Engineers.**
    3. **Depending on the level of impact, permit approval may require from 30 days to one year. Project planning efforts should accommodate time required for permit preparation and approval.**
    4. **The project manager should be prepared to compensate for any loss of wetlands by creating new wetlands in another location or on the site**

Any modifications in wild horse management will include methods of conserving wetlands on NTTR. It is a well-known fact that wild horses, especially in high populations, cause extensive damage to wetlands, riparian areas, and sensitive vegetation associated with these environments. If wetlands are being impacted by wild horses, 99th CES/CEVN should coordinate with BLM to ensure that the wetland areas are fenced to prevent encroachment by horses. Open water tanks should be placed outside of the wetland exclosure to provide water for the wild horses. This will allow the horses to access water, while also conserving the wetlands. Open-water basins should be physically separated from water in the wetlands to prevent damage to wetlands due to sediment accumulation and contamination by animal wastes.

4.6.3.5 Projects

Project	Goal	Project No.	Due Date
1. Delineate and determine the jurisdictional status wetlands potentially impacted by the military mission. These surveys should include all information required by the USACE for a standard field determination of wetlands.	1	Range, Survey-Monitor-Maintain, Wetlands/Seeps/ Springs	2007 - 2008
2. Wetland delineation data collected from surveys should be mapped and incorporated into the natural resource database. Wetland information from the Dames and Moore project should be incorporated into the natural resource database. Links to wetland reports should be included, and the reports should be converted into PDF files for reference. Any new wetland data or modifications of old data should be included in the natural resource database. The data should also be converted into sensitivity scoring for use in the GIS database model for natural resource management planning.	2	Range, GIS Database and Aerial Photography	Dec. 2006
3. Wetlands and associated plant communities should be evaluated and monitored annually to assess ecosystem health.	1	Range, Survey-Monitor-Maintain, Wetlands/Seeps/ Springs	Annual
4. Update the natural resources GIS database with additional information on wetlands and any monitoring data that may be appropriate.	2	Range, GIS Database and Aerial Photography	Annual

4.6.3.6 References

Literature Cited

Dames and Moore. 1997. Nellis Air Force Range Wetlands Survey Report.

NAFB. 1997. *Wetland Survey Report.* Air Force Project No. RKXF956044. Las Vegas, Nevada.

NAFB. 2002. Environmental Baseline Survey Dunning Circle Housing Area. Nellis AFB, Nevada.

Wetlands Training Institute, Inc. 1995. *Field Guide for Wetland Delineation: 1987 Corps of Engineers Manual.* WTI 95-3. Poolesville, Maryland.

Additional References

Bechtel Nevada Ecological Services. 1999. Ecological Monitoring and Compliance Program: Fiscal Year 1999 Report. Las Vegas, Nevada.

Bechtel Nevada Ecological Services. 2002. Ecological Monitoring and Compliance Program Fiscal Year 2002 Report. Las Vegas, Nevada.

Department of the Air Force. 1999. Renewal of the Nellis Air Force Range Land Withdrawal Legislative Environmental Impact Statement. Nellis AFB, Nevada.

Nature Conservancy. 2000. Ecoregion-Based Conservation in the Mojave Desert with a Contextual Analysis for Nellis Air Force Base and Ranges: Volumes I and II.

Nellis Air Force Base. 2002. Environmental Baseline Survey Water Wells Annex. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Draft Environmental Baseline Study: Nellis Terrace Housing Area. Nellis Air Force Base, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Manch Manor Housing Area. Nellis AFB, Nevada.

U.S. Army Corps of Engineers, Omaha District. 2001. Environmental Assessment: Live Ordnance Departure Area (LODA) at Nellis Air Force Base. Prepared for Environmental Management Office, 99th CES, Nellis AFB, Nevada.

4.6.4 Floodplains

4.6.4.1 Description of Current Conditions

In 1996, a study was conducted for NTTR to delineate hydrographic basins and floodplains (NAFB, 1997). This report actually only identified playas and lakebeds, but is used to provide the summary for the INRMP. Figure 4-12 shows the lakebeds delineated by the 1997 report. These lakebeds have been incorporated into GIS and can easily be transferred to the natural resource database. Floodplains have been mapped by the Clark County Emergency Management Department for NAFB and the Small Arms Range and are currently available in shape files.

Because of arid conditions at NTTR, significant storm events occur only occasionally, and mostly during the winter months. These rain storms can cause flooding, especially when combined with snowmelt in the spring. On the average, localized thunderstorms can produce high intensity, short duration, rainfall events that can result in flash flooding occur approximately 13 times per year at NTTR. Following a storm event, water tends to collect as surface runoff for a short period of time. Water collected by these storm events is only temporarily present and

usually collects in the low-permeability playas. Some channel flow from snowmelt and precipitation events may also occur.

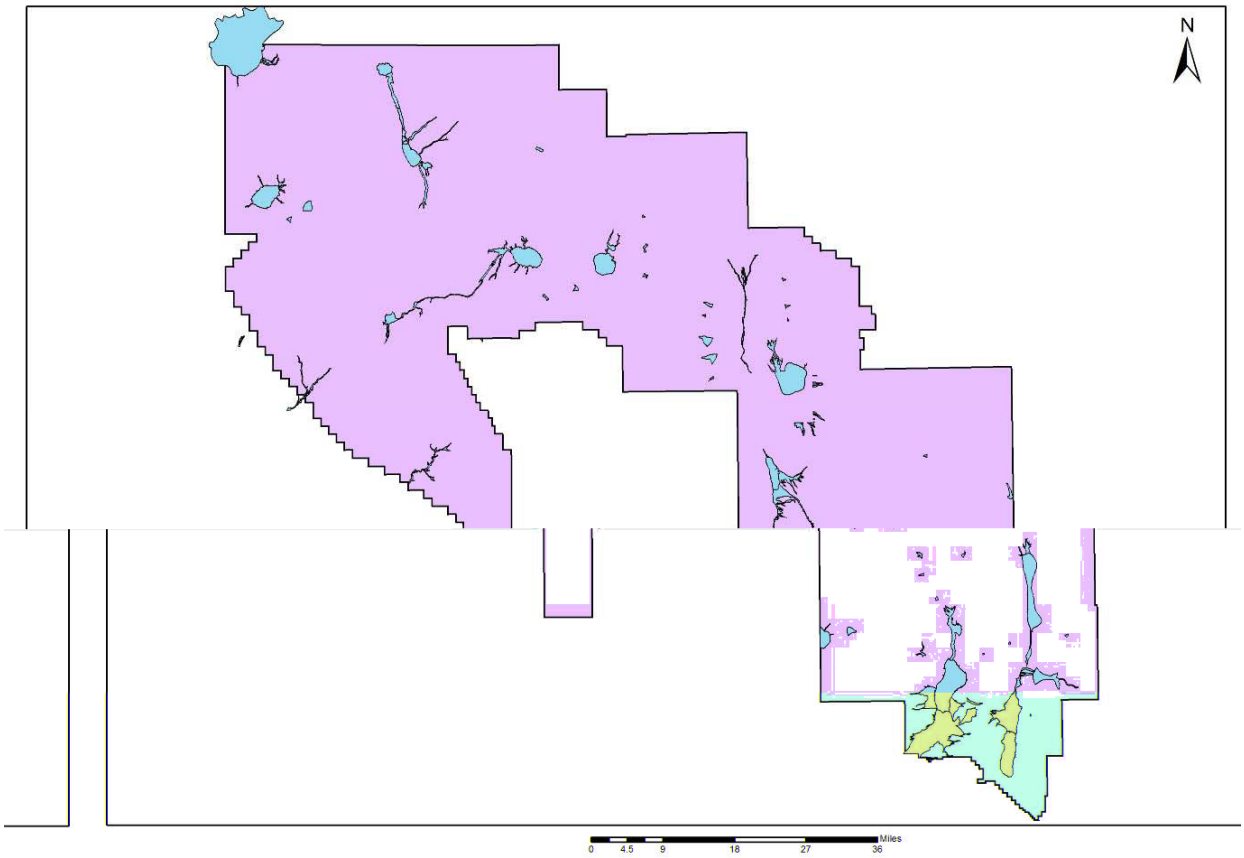
Surface drainage in NTTR generally collects in playas of the major valleys, but does not contribute to groundwater recharge, due to the low surface infiltration potential. Most of the water that collects in the playas is lost through evaporation.

In general, NTTR consists of three broad categories for conveyance of storm water runoff:

- Mountains
- Piedmont plains
- Base-level plains or alluvial valleys

Mountain area runoff usually follows steep, scoured, and rocky channels with narrow or non-existent floodplains. Runoff from mountain areas is relatively rapid and usually enters piedmont plains, which serve as a transitional area between the mountains and base-level plains. The slope of piedmont plains is much less than mountain areas, and therefore, runoff is somewhat slower. Runoff on piedmont plains is usually conveyed by piedmonts (erosional surface cut on a rock, usually covered with a thin layer of alluvium), alluvial fans, or old fan remnants across piedmont plains.

Figure 4-12. Flooplains as mapped on NTTR. No floodplains have been mapped for NAFB.



Base-level plains, or alluvial valleys, have very shallow land slope and usually end in a low topographic area or playa. Storm water passes through the base-level plains or alluvial valleys in

defined channels that have floodplains that are generally wide and flat. These well-defined channels with adjacent floodplains are defined as valley collectors. The topographical low areas or playas ultimately collect in pond storm water runoff. In NTTR, most of the storm water runoff is confined in closed basins and does not flow beyond playas. Floodplains play an important role in natural resource management. Knowledge of the location of floodplains is important in determining sites for targets, roads, and structures. These areas should be avoided to minimize damage caused by floods or high-velocity waters. Floodplains also provide temporary food and habitat for birds and other transient wildlife populations. In addition, many of the floodplain areas provide vernal pools, which are habitat for various invertebrates.

4.6.4.2 Needs Assessment

Need: The floodplain study conducted in 1997 is not considered completely accurate or comprehensive. More definitive delineation of 100-year floodplains should be conducted.

Assessment: Consultation with 98th RANW and 99th CES indicates that the floodplain study conducted in 1997 delineated playas and lakebeds, but did not delineate 100-year floodplains, especially in and along washes. Mission activities should be reviewed to determine if they could potentially modify flood flow or volume. If a significant impact is anticipated, the flood-

- **If impacts are unavoidable, floodplains should be remapped to accommodate those changes. Impacts caused by the change in floodplain characteristics should also be evaluated to determine if any sensitive areas are affected.**
- **Wherever possible, structures should not be constructed in 100-year floodplains. In addition, to prevent damage from floodwaters, vehicles and other equipment should not be left in 100-year floodplains.**
- **Hazardous waste, solid waste, fuels, and lubricants should not be stored within the boundaries of any 100-year floodplain.**

4.6.4.5 Projects

Project	Goal	Project No.	Due Date
1. Floodplains within NAFB should be either mapped, or maps should be obtained. This information is critical for planning mission activities and preventing damage to equipment and personnel.	1	Range, Survey-Monitor-Maintain, Wetalnds/Seeps/Springs	Dec. 2008
2. Mission activities involving construction or excavation in 100-year floodplains since 1996 should be reviewed to determine if those activities altered the floodplains. If alterations are identified, floodplains should be remapped, and the data should be incorporated into the natural resource database.	1	Range, Survey-Monitor-Maintain, Wetalnds/Seeps/Springs	Annual
3. Information from the original floodplain project for NTTR should be incorporated into the natural resources database until accurate and current data is available.	1	Range, GIS Database and Aerial Photography	September 2006
4. Floodplain maps for NTTR should be verified, expanded, and corrected. Corrections should be incorporated into the natural resources GIS database.	1	Range, Survey-Monitor-Maintain, Wetlands/Seeps/Springs	Dec. 2009

4.6.4.6 References

Literature Cited

NAFB. 1997. Final Floodplain Inventory Report.

Additional References

Nellis Air Force Base. 2002. Environmental Baseline Survey Water Wells Annex. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Draft Environmental Baseline Study: Nellis Terrace Housing Area. Nellis Air Force Base, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Manch Manor Housing Area. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Dunning Circle Housing Area. Nellis AFB, Nevada.

U.S. Army Corps of Engineers, Omaha District. 2001. Environmental Assessment: Live Ordnance Departure Area (LODA) at Nellis Air Force Base. Prepared for Environmental Management Office, 99th CES, Nellis AFB, Nevada.

4.7 FLORA

4.7.1 Native Vegetation

4.7.1.1 Description of Current Conditions

The climate, geology, soils, and hydrology of an area play a key role in determining the plant communities that establish in any given location. The plants, in turn, determine the species of wildlife that can inhabit an area. Vegetation is an excellent indicator of the health of an ecosystem. Plant composition can be used to determine the carrying capacity of an ecosystem and, in turn, determine if the capacity of the ecosystem is being exceeded. Plant composition can be used to predict the time required for a plant community to recover from an impact if the successional stage of the plant community has been determined. Specific species of plants that have been found to be sensitive to specific impacts can be used as indicators to determine if an area has been impacted. In short, vegetation information is probably the best tool for use by the natural resource manager to monitor the health of the ecosystem and to make well-founded decisions for project planning with respect to wildlife management.

Historic Review of Vegetation

Because the Las Vegas Valley, in which NAFB is located, was widely settled for a long period of time and NTTR is remote with only isolated, small settlements, more historic vegetation information is available for NAFB. On NTTR, the historic composition and structure of the vegetation is essentially unknown (Beatley, 1976). However, much of NTTR has remained undisturbed for years with some remote areas potentially experiencing little or no direct impacts by EuroAmericans.

In historic times, the Las Vegas Valley contained many natural artesian springs and the peren-

),.4(elowTw(egetatiojT]TJ/500019TJ21.612 0 TD0.TD0 Salixc0

pean settlement began in the area. Settlers extracted increasing amounts of groundwater for human consumption, livestock, crop production and, by 1905, for steam locomotive operation. The first well was drilled in 1907. Withdrawals continued and eventually the demand exceeded the recharge rate. Riparian habitats were gradually reduced and were eventually replaced by a modern urban landscape supporting a city of more than one million residents today. Substantial valley subsidence (decreasing elevation) has resulted from aquifer withdrawal in excess of recharge. Some remnants of historic riparian plant communities are still present in the valley, most notably at the Las Vegas Valley Water District well field, which is now bounded by residences, a large shopping mall, and a six-lane highway. The well field is closed to the general public.

Historically, most of NTTR was only accessible by foot or on horseback. With the advent of motorized travel it has become more accessible, although access is still limited for safety and security reasons. Most early EuroAmericans traveling through the NTTR area did not find the area hospitable for settlement, with the prominent exception of those who stayed briefly to extract mineral resources. It is likely that historic vegetation impacts did occur in the vicinity of mining settlements, townsites, and homesteads. The grazing of domestic livestock (Noss and Cooperrider, 1994), reduction of native herbivores (through hunting, competition for forage and water with livestock, and the consequences of livestock diseases on wildlife populations), and wood harvesting for both fuel and structural material likely impacted the composition of vegetation in the North Range. In the absence of historic records the degree of this impact is unknown, and the degrees of impact on, and subsequent recovery of, native vegetation cannot be accurately evaluated. Current observations suggest that lower elevations and bajadas on the South Range were dominated by vegetation typically found in the creosote bush/white bursage and saltbush (*Atriplex* sp.) communities, and on the North Range by the blackbrush (*Coleogyne ramosissima*) and Great Basin desert scrub communities. Current research suggests that blackbrush was more widespread in historic and pre-historic times. Vegetation on the low-lying playas of valley floors on the North and South Ranges is predominantly either shadscale or saltbush communities. Single-leaf pinyon (*Pinus monophylla*) and Utah juniper (*Juniperus osteosperma*) likely dominated higher elevations.

Vegetation types that occur on NAFB and NTTR have mostly been characterized and described according to the plant community classification system used by Beatley (1976) for studies conducted on the Nevada Test Site and other portions of Nye, Lincoln, and Clark counties. In this system, a plant community is named after the dominant and co-dominant plant species.

Utah State University has prepared a vegetation map of Nevada as part of the nationwide GAP program. Coverage includes the NAFB and NTTR. While relatively broad in scope, it still provides a general baseline to use to characterize the vegetation communities present on NTTR in the absence of more definitive data and will be used in the natural resource database until more definitive vegetation studies have been conducted for the area. The vegetation has been mapped on a small area in the South Range and a large area in the North Range as shown in Figures 4-13 and 4-14. The data were developed with satellite imagery, on photographs with 30 m x 30 m resolution. Aerial photography in conjunction with ground truth data collection by qualified botanists should be conducted to support the past studies as well as mapping of new areas. GAP data could be used as the starting point and later improved by the more specific aerial photograph/ground truth studies.

NAFB Vegetation

Large expanses of the valley floors in the Mojave Desert support the creosote bush/white bursage community (Vasek and Barbour, 1997). Creosote bush and white bursage dominate plant communities at elevations from below sea level to about 3,940 ft. This desert scrub community is characteristic of much of the Mojave Desert and can still be observed in less developed areas of NAFB, such as in the eastern portion of Area II and the Small Arms Range. Historic riparian vegetation associated with spring pools, outflow channels, and washes, dominated by cottonwood and mesquite (*Prosopis glandulosa P. pubescens*), is present in the Las Vegas Valley Water District north wellfield (Bradley and Deacon, 1967). Tamarisk, or salt cedar (*Tamarix* spp.), is an introduced (non-native) perennial plant species that has had the most notable effect on these plant associations. The most common tamarisk in the region is *T. ramosissima*, an arborescent shrub that is an aggressive colonizer of areas where groundwater is shallow or where seasonal moisture is available. Tamarisk is known for releasing salt into surrounding soils which, in combination with the plant's aggressive growth and colonization, often results in the establishment of dense, monospecific stands that often preclude the establishment of native species.

Vegetation community typical of Area III at NAFB.

Las Vegas bearpoppy (*Arctomecon californica*) and Las Vegas buckwheat (*Eriogonum corymbosum*) are two plant species of concern present on gypsiferous soils in NAFB. These species have been observed in three different locations on NAFB. Las Vegas bearpoppy is listed as a critically endangered plant by the state of Nevada and the Las Vegas buckwheat has been placed on several watch lists as a rare species. The occurrence of these plants on NTTR is not known, but the South Range lies within the range of these plants and gypsiferous soils are present. Thus populations of both species may be present. These plants are discussed in detail in the species of concern section of the INRMP.

NTTR Vegetation

The South and North Ranges generally lie in the Mojave and Great Basin biogeographic provinces, respectively, as described by Brown (1982). A biogeographic province is a widespread region that is characterized as distinct from another such region, primarily on the basis of different predominant vegetation and wildlife habitat types. The South Range generally encompasses an area that supports vegetation and habitat types that are characteristic of the Mojave Desert province; whereas the North Range generally encompasses an area that supports vegetation and habitat types characteristic of the Great Basin Desert province.

One indirect, widespread, and persistent effect of EuroAmerican presence in this area, as elsewhere in the West, is the presence of introduced annual and perennial plants, which sometimes dominate local vegetation and are considered invasive species. The three most prominent annual invasives are tumbleweed or Russian thistle (*Salsola tragus*), red brome (*Bromus rubens*),

and cheat-grass (*B. tectorum*). Red brome is desert-adapted and has become common on the South Range, while cheat-grass is adapted to cooler steppe environments, and therefore occurs primarily on the North Range. Both grasses are found in remote habitats that otherwise appear pristine and unaffected by EuroAmerican activities. Russian thistle, red brome, and cheat-grass are aggressive colonizers on disturbed soils, and they have replaced native annual populations in some areas. If disturbance is not repeated Russian thistle often does not persist. However, red brome and cheat-grass can continue to be the dominant annuals in certain habitats regardless of the disturbance regime. The pest management program for NAFB/NTTR includes control and management of invasive plants.

South Range Plant Communities

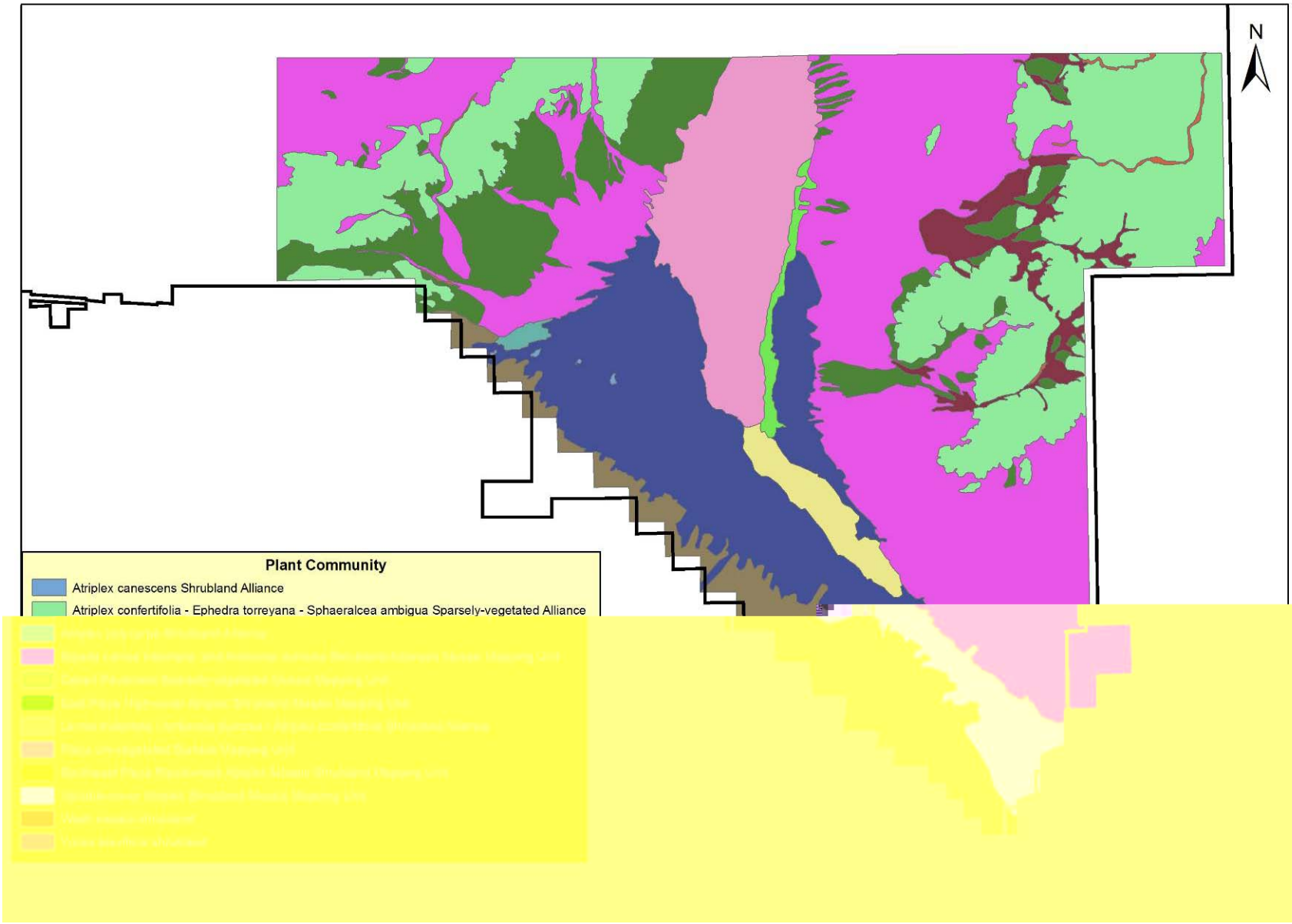
The South Range lies in the northeastern portion of the Mojave Desert, among the driest of North America's arid lands, where precipitation is often less than 4 in per year (Rundel and Gibson, 1996). Creosote bush/white bursage and saltbush communities are the most common vegetation communities on the South Range. Where soils are especially alkaline and clay-rich, as on the margins of dry lake beds (playas) at the lowest elevations, saltbush species including four-wing saltbush (*Atriplex canescens*), cattle-spinach (*A. polycarpa*), and shadscale (*A. confertifolia*) dominate the vegetation. Saltbush communities, especially near playas, may consist exclusively of these species.

Vast areas of the basins and bajadas in the Mojave Desert, below approximately 3,940 ft, support plant communities dominated by creosote bush and white bursage. Saltbush species, ephedras (*Ephedra* spp.), brittlebush (*Encelia virginensis*), desert mallow (*Sphaeralcea ambigua*), cacti (especially prickly pears and chollas [*Opuntia* spp.]), and Mojave yucca (*Yucca shidigera*) may also occur in this community.

At higher elevations (approximately 3,940 ft to 5,900 ft) blackbrush often is the dominant plant in the community. This plant community includes blackbrush (*Coleogyne ramosissima*), ephedras, turpentine-broom (*Thamnosma montana*), and range ratney (*Krameria parvifolia*). Joshua tree (*Yucca brevifolia*) is another plant that may occur at higher elevations within the creosote bush-white bursage and the blackbrush communities. Current research suggests that the blackbrush community was more widespread in previous centuries but currently is experiencing widespread range reduction (Lei, in press). While it is rarely the dominant species in terms of numbers or cover in these communities, the Joshua tree contributes a significant proportionate biomass in the local area, and its mature height of up to 20 ft contributes to its visual domination over the surrounding low shrubs, most of which grow to less than 3 ft tall.

The sagebrush/pinyon-juniper community comprises a woodland that is present on NTTR and is distinctive of the higher elevations of the Mojave and Great Basin Deserts above at least 4,920 ft elevation, and usually above 5,900 ft. At these higher elevations, increased precipitation and lower temperatures facilitate the development of this woodland habitat. The dominant species include big sagebrush (*Artemisia tridentata*), single leaf pinyon and Utah juniper in habitats with deeper soils, and black sagebrush (*A. nova*) in areas with shallow, rocky soils. Joint fir (*Ephedra viridis*) and rabbitbrush species (*Chrysothamnus* spp.) are common sub-dominants in this woodland. Although they were much more widespread in the lowlands during the last glakjmn cial age, post-glacial desertification led to the restriction of this woodland to the highest mountains of the South Range (Spaulding, 1985, 1990).

Figure 4-13. Plant communities mapped on the South Range of NTTR. Code numbers refer to specific plant community names.



The blackbrush and sagebrush/pinyon-juniper communities are more limited in distribution, being restricted to higher elevations than the creosote bush/white bursage and saltbush communities. A relict population of single-leaf ash (*Fraxinus anomala*), consisting of only a few individuals, is present on the west side of the Pintwater Range, in Range 64 (NAFB, 1997).

North Range Plant Communities

The *hydrographic* Great Basin was described and named by J.C. Fremont in 1844. While crossing over multiple mountain ranges on his east-west travels, Fremont recognized the valley floors he encountered did not have hydrologic outlets, a condition called endorheic (Hubbs et al., 1974). The Great Basin is a collection of endorheic basins that lie between north-south trending mountain ranges. Most of the precipitation that falls, the bulk of it as snow, remains in the region until it is absorbed into the ground or evaporated, but is not drained from the region. Though the region is warm in the summer and has low relative humidity throughout the year, low temperatures and typically strong winds during the winter make this one of the coldest desert regions in the United States. The entire NTTR lies within the hydrographic Great Basin, with the exception of the southern tip of Range 63.

The Great Basin Desert *floristic region* was defined by Shreve (1942) as that region typified by sagebrush and saltbush vegetation north of about the latitude of Beatty, Nevada. In this region winter temperatures are too low to support plants typical of the warmer deserts of the Southwest, such as creosote bush. Therefore, while both the North and South Ranges lie within the hydrographic Great Basin, only the North Range lies within the floristically-defined Great Basin Desert, while most of the South Range lies within the Mojave Desert.

The vegetation of the basin floors of the North Range is typified by shadscale and greasewood (*Sarcobatus vermiculatus*). Both of these salt-tolerant shrubs may occur in relatively monotypic stands, or may be co-dominant with winter fat (*Krasheninnikovia* [*Ceratoides*] *lanata*) and green molly (*Kochia americana*). Intermediate elevation slopes are dominated by Great Basin mixed desert scrub characterized by various species of horsebrush (*Tetradymia* spp.), rabbitbrush (*Chrysothamnus nauseosus, C. viscidiflorus*), hopsage (*Grayia spinosa*), greasewood, shadscale, and sagebrush (typically budsage, *Artemisia spinescens*). With increasing elevation, the predominance of junipers and pinyons increases with an understory of black sagebrush. Other species that occur in this community include rabbitbrush, joint fir, and occasional Joshua tree. Greasewood may occur as a co-dominant with sagebrush. The blackbrush community reaches its northernmost limit on upper bajadas below the western face of the Groom Range mountains (Beatley, 1976). Elsewhere, blackbrush vegetation occurs in the southerly portions of the North Range at intermedi-

Sagebrush/piñon-juniper plant community found in the Cactus Range.

ate elevations between the shadscale community and sagebrush-pinyon-juniper community. The dominant vegetation in the North Range mountains above 4,920 ft elevation is sagebrush-pinyon-juniper woodland. White fir (*Abies concolor*) occurs at elevations above approximately 8,200 ft on Bald Mountain in the Groom Range (Beatley, 1976), with single-leaf pinyon and limber pine (*Pinus flexilis*). Figure 4-14 shows plant communities that have been mapped on the North Range of NTTR.

Transition Zone

One issue on NTTR is the location and extent of a vegetation transition zone between the two deserts, an area that would be expected to include plants from both deserts distributed in a mosaic pattern. Specific indicators of this transition might also be identified. In the existing scientific and technical literature, the author who most directly addressed this issue was Beatley (1976). Beatley identified and described a vegetation transition zone dominated by blackbrush and other plants, such as boxthorn species (*Lycium* spp.), hopsage, and saltbush species, located largely on the Nevada Test Site (see also Beatley, 1975; El-Ghonemy et al., 1980). Extrapolation of Beatley's transition zone boundaries suggests that little of it is represented on either the North or South Ranges, with the notable possible exception of EC South. Alternatively, if the simpler, single boundaries proposed by other authors are more accurate, then more substantial amounts of the boundary or transition may be represented on the Range. Johnston et al. (1992) note that transition zone boundaries can be difficult to determine, especially where community changes are gradual.

This transition zone represents an important region on public lands because it supports species from different biotic regions. A greater diversity of plant and animal species is likely to be found there, which may harbor unique species. Transition zones serve as corridors for some species and as barriers for others, because the transitional habitats can be optimal for some species while being inhospitable for others. On geologic time scales, they are often ephemeral, usually persisting less than 10,000 years (Hansen and diCastri, 1992).

The Nature Conservancy (TNC) conducted a statistical analysis of the vegetative makeup of 185 plots on NTTR, sampled between 1994 and 1997. Of the 185 plots, 78% were classified as either Great Basin or Mojave Desert vegetation types, 15% were classified as transition vegetation, and 7% were unclassified. Sampling of 185 plots was considered a bare minimum, and further sampling was strongly recommended. However, the available data support the hypothesis that the majority of the Range vegetation is closely associated with one desert or another. The Great Basin/Mojave Desert transition, where present, represents a small percentage of NTTR vegetation (NAFB, 1997).

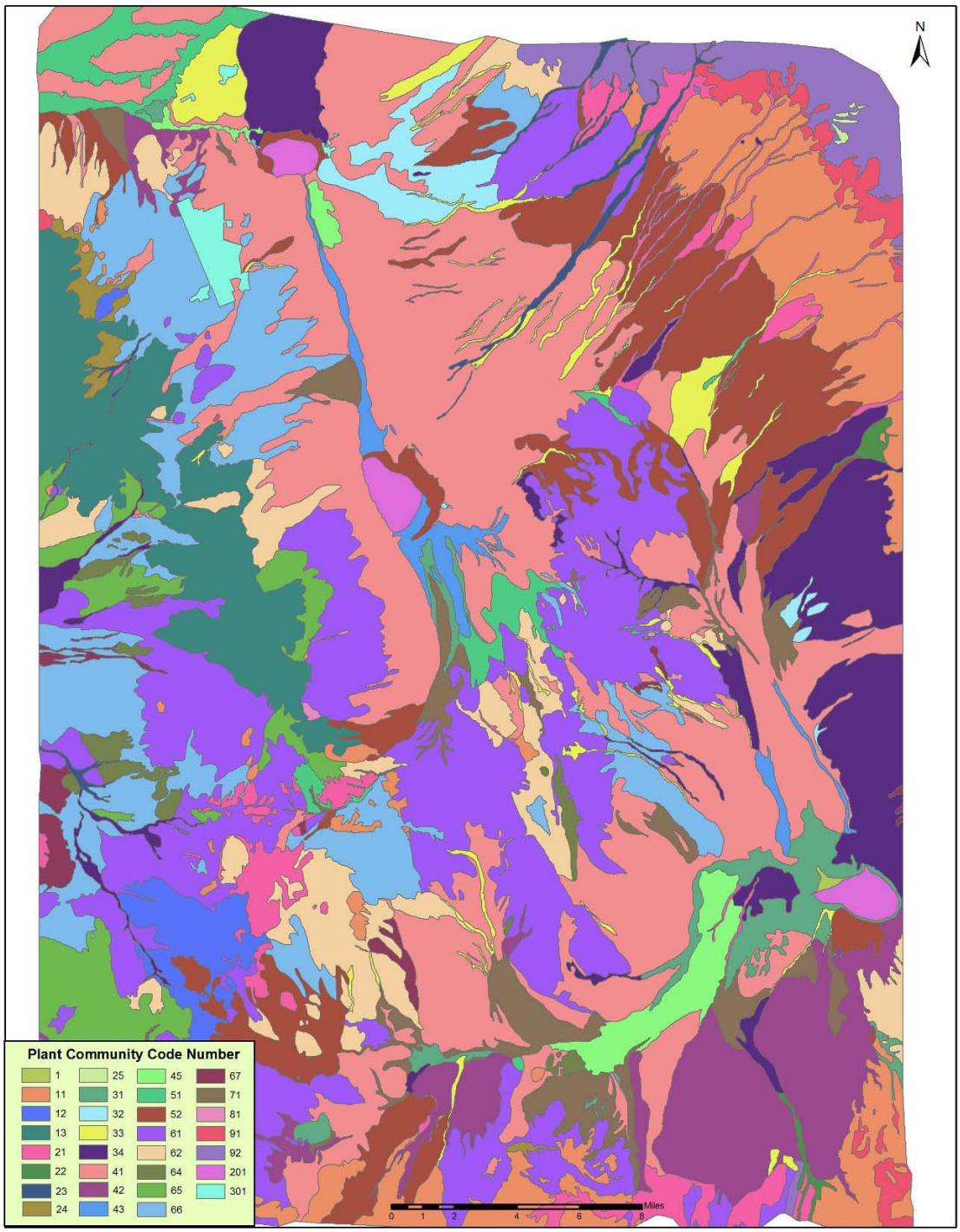
4.7.1.2 Needs Assessment

Need: To understand and manage existing vegetation, it is necessary to quantitatively describe plant community attributes, such as cover and composition. Strategies for monitoring vegetative change are implemented as a means to relate land use activities to their effects on the vegetation. Very little is known about the plant communities in NTTR. This information is critical for proper planning and proper management of natural resources. Vegetation is an excellent barometer of the health and well-being of the ecosystems existing in NTTR and NAFB.

Assessment: A vegetation mapping survey of NTTR and NAFB has not been completed at the time of publication of this INRMP. Mapping has been completed for a large area in the North Range and a small area in the South Range. Most of this mapping was based on satellite im-

agery and remote sensing, and it requires ground-truthing by qualified botanists. Rare plants found in NTTR and NAFB have been mapped and identified in a study conducted by the Nature Conservancy in 1997. However, that study only covered rare plants and did not discuss or map vegetation communities in the area.

Figure 4-14. Plant communities mapped on the central portion of the North Range of NTTR. Code numbers refer to specific plant community names.



Need: An important tool required for vegetation mapping is aerial photography. Recent aerial photos of NTTR are not available.

Assessment: Once vegetation is surveyed and mapped on NTTR and NAFB using aerial photography and ground truthing, the data can then be used to identify sensitive areas providing a means for planners to minimize impacts to natural resources. In addition, information collected on vegetation surveys will simplify the preparation of environmental assessments and environmental impact statements by providing the raw material necessary to identify impacts and to predict recovery from impacts. A comprehensive database of vegetation information will expedite compliance with NEPA.

Well-planned condition and trend monitoring will assist with habitat evaluation and the establishment of priorities for restoration activities. Monitoring will also guide and support fire management planning. It will set the stage for the more focused assessments which may be required in breeding, foraging, and nesting areas for wildlife, and in sensitive areas, such as sensitive botanical areas and riparian vegetation.

Additional monitoring procedures may need to be designed to address species-specific questions. Questions related to species, habitats, restoration techniques, and land use impacts may require further understanding because of their sensitivity or potential for affecting operational requirements on NTTR. Other methods are needed because landscape level monitoring of communities is not suited to answering species-level or site-specific questions. It is also not usually suited to the early detections of change, such as invasion by exotics or new erosion sites.

Conservation objectives can be advanced most effectively by providing suitable locations for execution of military missions and expansion, an approach actively supported by 98th RANW. Military mission and intensity is determined by training requirements. If the mission requirements are such, then damage could be extensive and evident for decades. Damage associated with mission activities should be minimized and repaired where applicable to ensure range sustainability for future military missions. In arid communities, which tend to be much less resilient than more mesic areas, the damage from training or expansion will be evident for decades. Therefore, NTTR is recognized as being subject to major negative environmental impacts by activities that would, in non-desert parts of the country, be relatively short-term and insignificant in nature.

4.7.1.3 Management Goals within the Mission

GOAL 1: Develop a GIS database layer comprised of up-to-date, color aerial photography for NTTR and NAFB. Using plant community data, a sensitivity map should be developed for use by mission planners.

GOAL 2: Using aerial photography, GPS, and ground-truth surveys, delineate plant communities found in NTTR and NAFB

GOAL 3: Conserve unique plant communities identified at NAFB and NTTR.

4.7.1.4 Management Guidelines

The military mission always takes precedence over the guidelines recommended in the INRMP. Managers should adhere to the guidelines within the constraints of the mission.

During the early planning of any project at NTTR, the following steps should be taken:

- **Vegetation maps, if available, will be reviewed to determine if the site for the action contains plant communities known to be sensitive or to support sensitive wildlife species.**
- **If vegetation maps are not available, proposed site as well as alternative sites should be surveyed to identify plant communities in the area. These communities should be mapped and data entered into the natural resource database.**
- **For activities involving soil disturbance or vegetation removal:**
  - **Where applicable or required by federal resource agencies, the top six inches of soil should be excavated separate from deeper soils and stockpiled in a separate location. Any excavations should be backfilled with deep soils first, with the topsoil being backfilled as the final layer. This allows the site to have a final layer of soil that approximates original soil conditions and that contains a relatively healthy seedbank for regrowth of vegetation.**
  - **Soils should be lightly rolled or compacted to decrease the potential for wind erosion.**
  - **Initial irrigation may be used to stimulate germination of seedling plants, but should not be continued to prevent adaptation of the plants to an artificially wet environment, causing them to not be drought-resistant. Ideally, plants should be allowed to germinate following the first storm event after project completion.**
  - **If nursery stock is used for replanting, all plants should be native and endemic to the specific area. Some species could be transplanted from adjacent areas if desired.**
  - **Encroachment of Russian thistle and other invasives should be prevented, and plants becoming established should be removed if at all possible.**
- **Issues to be addressed by natural resource manager:**
  - **Because of the sensitivity of riparian plant communities to impacts and their importance in functional values for the ecosystem, Mission actions should be planned and sited in a manner to avoid these areas. Similarly, vegetation communities associated with springs, seeps, and wetlands should also be avoided wherever possible.**
  - **Aerial photography should be conducted for NTTR and NAFB on a five-year cycle. Photos should be incorporated into the natural resource database and used to monitor the areas for any significant changes in vegetational characteristics, disturbance to soils, and other significant changes and features.**
  - **In areas currently inhabited by wild horses, vegetation should be carefully monitored to determine grazing pressure on the plant community. Horse populations should be managed in a manner to minimize pressure on plant communities that may result in degradation of plant composition and poor range conditions. Riparian plant communities, wetlands, seeps, and springs should be protected by exclosures to prevent direct impacts by grazing and watering wild horses.**
  - **Landscaping and vegetation in more developed portions of NAFB and NTTR should incorporate native, xerophytic plants to allow for minimal maintenance and water usage. Native grasses should be used for landscaped areas whenever possible.**
  - **In an effort to protect vegetation, no new livestock grazing allotments and no forest product removal will be allowed on NTTR.**

4.7.1.5 Projects

Project	Goal	Project No.	Due Date
1. Develop and ground truth a natural resources GIS database layer comprised of GAP data from the State of Nevada to be used as the baseline for development of a sensitivity model for project planning.	1,3	Range, GIS Database and Aerial Photography	December 2007
2. Using true color aerial photographs, the South Range should be photographed and analyzed for determination of plant communities every 5 years. Ground truth work will be conducted in conjunction with the geology and soils surveys.	2	Range, GIS Database and Aerial Photography	December 2006 and June 2011
3. Using true color aerial photographs, the North Range should be photographed and analyzed for determination of plant communities every five years. Ground truth work will be conducted in conjunction with the geology and soils surveys.	2	Range, GIS Database and Aerial Photography	June 2007 and June 2012
4. Monitor fences protecting riparian plant communities for damages and need for repair. Annually monitor sensitive habitat within the exclosures.	3	Range, Monitor Habitat	Annual
5. Locate with GPS and monitor rare plant communities found by the Nature Conservancy studies and any new communities identified during vegetation surveys and other projects.	3	Range, Survey-Monitor-Maintain, Wetalnds/Seeps/Springs	Annual

4.7.1.6 References

Literature Cited

Beatley, J. C. 1976. *Vascular plants of the Nevada Test Site and central-southern Nevada: Ecologic and geographic distributions*. Technical Information Center, Energy Research and Development Administration.

Bradley, W. G., and J. E. Deacon. 1967. The biotic communities of southern Nevada. *In*: *Pliestocene Studies in Southern Nevada.* Nevada State Museum Anthropological Papers, edited by H. M. Wormington, and D. Ellis. Nevada State Museum, Reno, Nevada.

Brown, D. E. (ed). 1982. Biotic Communities of the American Southwest - United States and Mexico. *Desert Plants*. 4:1-4.

El-Ghonemy, A. A., A. Wallace, and E. M. Romney. 1980. Socioecological and soil-plant studies of the natural vegetation in the northern Mojave Desert-Great Basin Desert interface. *Great Basin Naturalist Memoirs* 4.

Hansen, A. J., and F. diCastri (eds.). 1992. *Landscape Boundaries: Consequences for Biotic Diversity and Ecological Flows*. Springer-Verlag, New York, New York.

Johnston, C. A., J. Pastor, and G. Pinay. 1992. Quantitative Methods for Studying Landscape Boundaries. Pages 107-128 *In:* Hansen, A. J. and F. diCastri (eds.) Landscape Boundaries: Consequences for Biotic Diversity and Ecological Flows. Springer-Verlag. New York, New York.

Hubbs, C. L., R. R. Miller, and L. C. Hubbs. 1974. Hydrographic history and relict fishes of the north-central Great Basin. *Memoirs of the California Academy of Sciences*, Volume VII. San Francisco.

Jones, F. L., and J. F. Cahlan. 1975. *Water: A History of Las Vegas*. Las Vegas Valley Water District, Las Vegas, Nevada.

NAFB. 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.* Legacy Resource Management Program Support Agreement FB4852-94200-071. Las Vegas, Nevada.

Noss, R. F., and A. Y. Cooperrider. 1994. *Saving Nature's Legacy: Protecting and Restoring Biodiversity.* Island Press, Washington, D.C.

Rundel, P. W., and P. Gibson. 1996. *Ecological Communities and Processes in a Mojave Desert Ecosystem.* Cambridge University Press, Cambridge, Massachusetts.

Shreve, F. 1942. The Desert Vegetation of North America. *Botanical Review* 8(4):195-246.

Spaulding, W. G. 1985. *Vegetation and Climates of the Last 45,000 Years in the Vicinity of the Nevada Test Site, South-Central Nevada*. U. S. Geological Survey Professional Paper 1329. Denver, CO.

Spaulding, W. G. 1990. Vegetational and Climatic Development of the Mojave Desert: The Last Glacial Maximum to the Present. In *Packrat Middens: The Last 40,000 Years of Biotic Change*, edited by J. L. Betancourt, P. S. Martin, and T. R. Van Devender, pp. 166-199. University of Arizona Press, Tucson.

Vasek, F. G., and M. G. Barbour. 1977. Mojave Desert scrub vegetation. Pages 835-867 *In:* M. G. Barbour and J. Major (eds.) *Terrestrial Vegetation of California*. John Wiley and Sons, New York.

Additional References

Bechtel Nevada Ecological Services. 1999. Ecological Monitoring and Compliance Program: FY 1999 Report. Las Vegas, Nevada.

Bechtel Nevada Ecological Services. 2000. Classification of Vegetation on the Nevada Test Site. Nellis AFB, Nevada.

Black, Stuart C., Wayne M. Glines and Yvonne E. Townsend. 1995. U.S. Department of Energy Nevada Operations Office Annual Site Environmental Report 1994.

Dames & Moore. 1994. Herpetological Study in the Indian Springs Valley and Three Lakes Valley, Nellis Air Force Range. Nellis AFB, Nevada.

Dames & Moore. 1994. Biological Assessment of the Proposed CBU Target Site at the Nellis Air Force Range. Nellis AFB, Nevada.

Dames & Moore, Inc. 1996. Biological Resources Technical Memorandum. Environmental Assessment: Regional Training Area, Indian Springs Air Force Auxiliary Field. Nellis Air Force Base, Nevada.

Department of the Air Force. 1999. Renewal of the Nellis Air Force Range Land Withdrawal Legislative Environmental Impact Statement. Nellis AFB, Nevada.

EG&G. 1991. The Distribution and Abundance of Desert Tortoises on the Nevada Test Site. Nellis AFB, Nevada.

EG&G. 1994. The Northern Boundary of the Desert Tortoise Range on the Nevada Test Site. Nellis AFB, Nevada.

Nature Conservancy. 2000. Ecoregion-Based Conservation in the Mojave Desert with a Contextual Analysis for Nellis Air Force Base and Ranges: Volumes I and II.

Nellis Air Force Base. 1997. Bird Survey Report. Air Force Project No. RKXF956145. Nellis AFB and Nellis Air Force Range, Nevada.

Nellis Air Force Base. 1997. Nellis Air Force Base and Range Bat Survey Report. Nellis Air Force Base, Nevada.

Nellis Air Force Base. 2001. 2001 Vegetation Mapping at Nellis Air Force Bombing and Gunnery Range, Clark, Lincoln, and Nye Counties, Nevada: Indian Springs and Indian Springs NW 7.5' Quads.

Nellis Air Force Base. 2002. Draft Environmental Baseline Study: Nellis Terrace Housing Area. Nellis Air Force Base, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Manch Manor Housing Area. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Dunning Circle Housing Area. Nellis AFB, Nevada.

Nellis Air Force Base. 2003. 2002 Vegetation Mapping at Nevada Test and Training Range: Indian Springs SE and Black Hills SW 7.5' Quads. Nellis Air Force Base, Nevada.

Nevada Environmental Consultants, Inc. 1998. Biological Assessment: Bureau of Land Management Lands Selected for Withdrawal. Nellis Air Force Base, Nevada.

Nicoletti, Mary Jo. 1991. Mojave Desert Tortoise Survey at Range 63. Nellis AFB, Nevada.

SWCA, Inc. 1991. Biological Assessment for Mojave Desert Tortoise. Clark County, Nevada.

U.S. Army Corps of Engineers, Omaha District. 2001. Environmental Assessment: Live Ordnance Departure Area (LODA) at Nellis Air Force Base. Prepared for Environmental Management Office, 99 CES, Nellis AFB, Nevada.

United States Department of the Air Force. 1994. Final Report of Fall and Winter Surveys for Nine Wildlife Species on Nellis Air Force Base Area II. Nellis Air Force Base, Nevada.

United States Department of Defense Legacy Resource Management Program. 1997. An Inventory of 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, Part A: The Inventory.

United States Department of Defense Legacy Resource Management Program. 1997. An Inventory of 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, Part B: The Maps.

United States Department of Defense Legacy Resource Management Program. 1997. An Inventory of 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, Part C: The Vegetation Analysis.

United States General Accounting Office Report to Congressional Requesters. 2002. Endangered Species: Research Strategy and Long-Term Monitoring for the Mojave Desert Tortoise Recovery Program.

Yoakum, Jim. 1980. Habitat Management Guides for the American Pronghorn Antelope. U.S. Department of the Interior Bureau of Land Management, Denver Service Center, Denver, Colorado.

4.7.2 Turf and Landscape

4.7.2.1 Description of Current Conditions

Approximately 1,000 acres of NAFB are improved grounds, which include areas of turf grasses and ornamental landscaping that require regular maintenance, such as mowing, irrigation, and fertilizing. The preferred mixture of turf grasses for NAFB is a 60%/30%/10% mix of Kentucky bluegrass (*Poa pratensis*), Italian domestic ryegrass (*Lolium perenne* var. *multiflorum*), and creeping red fescue (*Festuca rubra* [*fallax*]). With regular irrigation this mix can be maintained as attractive turf. However, warm season grasses such as buffalograss, bermudagrass, or zoysia would require less irrigation and be better adapted to the desert environment. SNWA provides a complete lawn watering guide with precise watering schedules throughout the year. The Desert Demonstration Garden, supported by SNWA, is a valuable turf and landscape information resource for local needs.

The moderate winter climate regime of NAFB allows for the proliferation of a wide variety of deciduous trees, deciduous shrubs, evergreen trees, evergreen shrubs, perennials, ground covers, vines, and grasses. The NAFB land management plan includes a list of low-water, introduced, and native plants. A suggested planting list of drought-tolerant species has been prepared by University of Nevada botanists and many more suggestions are available from SNWA.

NAFB landscape is generally mature, and many trees, especially elms *(Ulmus* spp.), are reaching the end of their natural lives. Elms are known to be fast-growing and to reach early senescence. If young trees are planted now, this could reduce the future loss of natural cooling and aesthetic value from the loss of mature trees.

Approximately 18 acres of turf grasses are maintained at the CREECH AFB facilities. Deciduous and evergreen trees are also maintained at this installation, all supported with irrigation and shallow groundwater. Joshua trees and cacti planted in xeriscapes require no watering.

NAFB's land management practices are generally compatible with an ecosystem approach to natural resources management. However, several strategies can be employed to further sustain biodiversity and mitigate human-caused disturbances. Use of herbicides and pesticides should be minimized, especially in areas used extensively by wildlife (i.e., golf course ponds). Less persistent forms of pest control, such as integrated pest management, should be explored as alternatives. Landscape plans are being developed by 99th CES to determine areas where vegetation requiring frequent watering can be replaced with xeriscape species (landscape with low water requirements). Non-native plant species can be detrimental to overall ecosystem health because they often out-compete native species and alter community dynamics. Where feasible, non-native species should be replaced with native species. Grounds are not maintained on NTTR, with the exception of the 18 acres of turf grasses, various native and introduced tree species, and succulents at the CREECH AFB.

4.7.2.2 Needs Assessment

Need: In general, NAFB and NTTR have successfully implemented a xeriscape program for landscaping. However, many of the turf areas at NAFB, as well as the golf course, require relatively high levels of irrigation. Most of NTTR is not landscaped, and xeriscape is not an issue.

Assessment: As new varieties of native turf species are developed, these should be incorporated into the landscaping plan to decrease the water requirements for NAFB and NTTR. Buffalograss is a native grass which requires less irrigation than cool season grasses and should be promoted to replace cool season bluegrass, fescue, and ryegrass. In addition, there should be close coordination between the landscape planners and natural resource managers to ensure that native plant species are used for on-base landscaping and weeds to ensure that invasive species are controlled. Also, the natural resource manager should be involved in reviewing any changes in the pest management plan prepared by the base landscape group.

4.7.2.3 Management Goals within the Mission

GOAL 1: Assist NAFB and NTTR planners in developing xeriscape plans that minimize the need for irrigation.

GOAL 2: Comply with the current pest management plan enforced for NAFB and NTTR. This plan provides for judicious use of herbicides and pesticides in a manner that will minimize or even avoid impacts to the environment.

4.7.2.4 Management Guidelines

The military mission always takes precedence over the guidelines recommended in the INRMP. Managers should adhere to the guidelines within the constraints of the mission.

During the development and implementation of landscape and turf plans for NAFB or NTTR, the natural resource manager will do the following:

- **Review plant lists to ensure that only native, xerophytic plants will be used for landscaping.**
- **Review any plans for pest management to ensure that methods and types of pest control will not significantly impact sensitive species in the vicinity of the application area.**
- **Ensure that the NAFB landscape management plan and pest management plan are properly implemented and used at NTTR and NAFB.**

4.7.2.5 Projects

Project	Goal	Project No.	Due Date
1. The natural resource manager should annually review the landscaping and pest management plans to ensure that natural resources will not be impacted.	2	New: Vegetation/Soils/ Geologic Surveys	Annual
2. Develop a list of woody and herbaceous species that can be planted on NAFB and NTTR.	1	New: Vegetation/Soils/ Geologic Surveys	December 2007
3. Develop a course for identification of invasive species to be taught to appropriate personnel in an effort to identify the location of species and methods to eradicate them. The course should include identification and control methodologies.	2	New: Vegetation/Soils/ Geologic Surveys	June 2008

4.8 FAUNA

NAFB is located adjacent to the growing metropolitan Las Vegas area and is generally an urban environment with some adjacent unimproved lands. Although relatively undisturbed lands lie to the east and north of NAFB, many Mojave Desert species that might otherwise occur here are not present due to a lack of suitable habitat. The few native animals that continue to occur here are likely present because their habits allow them to adapt to an urbanized landscape.

Limited native habitat exists on the NAFB for wildlife. There are, however, at least five sensitive animal species that have been observed, or which may occur. Of the five, only the desert tortoise is federally-listed as threatened, and therefore is protected under the ESA. The western burrowing owl is a former USFWS C-2 species and species of concern. The chuckwalla is a former federal species of concern, and the phainopepla is a State of Nevada protected species.

The banded Gila monster is a State of Nevada protected species and a BLM sensitive species. There are 18 species of bats that potentially occur on NTTR and may also occur on NAFB. Seven of these 18 species were formerly classified as species of concern by USFWS.

NAFB natural resources include a diversity of wildlife species. Two goals of wildlife management on NAFB are (1) to conserve functioning ecosystems that maintain viable native habitat resources, and (2) to encourage or enhance wildlife species in disturbed habitats. These goals recognize that lands on the northern and eastern borders of NAFB have the potential for biotic exchange with the surrounding Mojave Desert ecosystem. Developing baseline species information, as well as conserving and enhancing the existing habitat, are effective management goals for maintaining biodiversity.

A large number of vertebrates are represented on NAFB and NTTR. Being a smaller, more urban location, NAFB has a smaller number and variety of species than are present on NTTR. Some records of vertebrate use were documented in early studies, and baseline data on birds and bats were collected during 1996 studies commissioned by 99th CES. Table 4-4 lists some of the species that may be present on NAFB, particularly in undeveloped areas to the north and east. The only fish found on NAFB are the tui chub (*Gila bicolor*), a minnow native to Nevada, coi (*Cyprinus spp.)*, and carp (*Cyprinus carpio*), all of which have been introduced into the golf course pond.

Due to the general lack of suitable aquatic habitat, the NTTR does not have any natural fish populations and amphibians are rare, but representatives of all other vertebrate classes are present. Reptiles characteristic of the Mojave and Great Basin deserts may be found on the South and North Ranges, respectively. Native birds and bats are found on NTTR, particularly near the few areas of open water. During spring and fall migrations, bird numbers and bird species diversity increase. Desert bighorn sheep may be found at higher elevations on NTTR during the summer and at lower elevations in the winter. Other large mammals present on both the North and South Ranges include the Desert mule deer (*Odocoileus hemionus*) and pronghorn antelope (*Antilocapra americana*) and carnivores such as the coyote (*Canis latrans*), badger (*Taxidea taxus*), bobcat (*Lynx rufus*), mountain lion (*Felis concolor*), and kit fox (*Vulpes macrotis*).

Fish and wildlife management can be defined as a coordinated process of actions specifically designed to maintain, enhance, and regulate indigenous wildlife and habitats. Management includes conservation of federal and state-listed species, non-game species, management and harvest of game species, reduction in bird aircraft strike hazard (BASH), animal damage control, and habitat conservation. Effective vegetation management (e.g., watershed management, fire management) will conserve the viability of wildlife populations. Various species of wildlife will benefit from 99th CES/CEVN's basic strategy to limit non-mission essential activities, avoid unnecessary development, and perform mitigation actions in areas supporting high densities of threatened or endangered species and in wetlands. Further, the basis of good management is an understanding of the diversity, abundance, distribution, population dynamics, and habitat requirements of species.

Game species on NTTR include Gambel's Quail (*Callipepla gambelii*), mourning dove (*Zenaida macroura*), desert cottontail (*Sylvilagus audubonii*), black-tailed jackrabbit (*Lepus californicus*), desert bighorn sheep (*Ovis canadensis nelsonii*), and mule deer. Although there is currently no trapping or hunting on NTTR except for yearly bighorn sheep hunts, hunting and trapping opportunities are available in nearby off-base areas of the ecosystems. Management practices bene-

fiting these species on and near NTTR include providing additional water sources and population inventories.

Developing a clear picture of current environmental conditions is fundamental to efficient ecosystem management. Military activities on NTTR appear to have minimal impacts on wildlife. Wild horses are responsible for overgrazing and excessive water consumption, which can adversely impact other species. With increased knowledge of the large mammals on NTTR, especially location and census information, better ecosystem management is possible. Some positive, concrete management results that would be possible with better data include locating sensitive habitats, actively managing plant and animal recovery, and coordinating appropriate species introductions via cooperative work with USFWS and NDOW. Some baseline data are now available on birds; however, additional knowledge could be gained from further studies of resident birds (i.e., nesting habits, sensitive habitats, and neotropical migrant study plots).

There is a lack of detailed population information for most wildlife species on NTTR. More quality information regarding population status, distribution, movement, and interactions of wildlife will aid the decision makers' task of identifying indicator species on NTTR. It will also make it easier to differentiate those activities that may have a significant negative affect on wildlife from those that do not.

4.8.1 Non-Game Species

4.8.1.1 Bats

4.8.1.1.1 Description of Current Conditions

Bats play an important role in the ecosystem because they feed on many different insects and pollinate various desert flowers. In 1997, a bat survey was conducted for Nellis Air Force Base (NAFB, 1997). In the report, it was stated that 20 species of bats could potentially occur in NTTR. Of those 20 species, six species were actually identified and included the long-legged myotis (*Myotis volans*), fringe-tailed myotis (*M. thysanodes*), California myotis (*M. californicus*), pipistrelle (*Pipistrellus hespereus*), Townsend's big-eared bat (*Plecotus townsendii*), and pallid bat (*Antrozous pallidus*). The California myotis was the most common species observed in the report and was found in almost all habitats that were sampled, including desert scrub, grassland, and woodland. Pallid bats were observed only in desert scrub communities, and fringe-tailed and Townsend's big-eared bats were found in a range of habitats from desert scrub to pinyon-juniper woodland. All of the bats observed on NTTR primarily used caves, abandoned mines, trees, and abandoned buildings for roosts. Preferred foraging and roosting habitat was usually located near open water or desert springs.

Some bats are year-round residents of NTTR and are believed to hibernate between October and April, while others migrate to warmer climates during the winter. Bats found in NTTR are primarily insectivorous and eat a variety of night-flying and ground-dwelling insects, including moths, beetles, flies, and grasshoppers. Basically, most bats are opportunistic feeders with no particular preferences for food.

4.8.1.1.2 Needs Assessment

Need: As previously mentioned, a bat survey was conducted in 1996 and 1997. This survey was not comprehensive, and further information on the distribution and composition of bat populations in NTTR and NAFB is needed.

Assessment: Bats can present hazards to low-flying jet aircraft, especially around seeps, springs, caves, and crevices in the early evening around sunset, when bats are typically active. Knowing the population dynamics and movements of bats would enable mission planners to know when activities could be modified in location or scheduling to avoid BASH issues involving bats.

Information is also needed on some of the more rare species of bats to determine if they are present on NTTR and if any special conditions are required to conserve those species. Although none of the bat species potentially inhabiting NAFB and NTTR are listed under the Endangered Species Act, some of the more rare species may eventually be listed, and information concerning them would be helpful to prevent listing in the future. This work could be conducted with assistance from USFWS, NDOW, BLM, NRCS, and USGS.

4.8.1.1.3 Management Goals within the Mission

GOAL 1: To identify and characterize bat populations in NTTR and NAFB in an effort to improve flight safety for aircraft flying over NTTR and identify the presence of any endangered or threatened species.

GOAL 2: To minimize impacts to bat populations by mission activities.

4.8.1.1.4 Management Guidelines

The military mission always takes precedence over the guidelines recommended in the INRMP. Managers should adhere to the guidelines within the constraints of the mission.

During the planning and implementation of mission actions, the natural resource manager should be consulted, concerning the following:

- **If the action impacts mines, wooded areas, seeps, springs, or abandoned buildings, the areas should be surveyed to determine if bats are present and if those bats are species of concern that should be conserved.**
- **Airfields should be surveyed to assess bat activity, especially in mines, abandoned buildings, and springs or seeps. If necessary, bat roosts in common flying areas should be closed and bats moved to another area, if possible. Roosts can be eliminated by closing mine shafts and removing buildings. Low level flight paths should avoid springs, seeps, and wetlands if at all possible to eliminate BASH issues.**
- **Coordinate with NDOW, USFWS, USGS, BLM, and NRCS to complete the inventory of NTTR and NAFB for bat species.**

4.8.1.1.5 Projects

Project	Goal	Project No.	Due Date
1. Bat roosting areas potentially impacted by mission activities should be surveyed to determine if bats are present and to determine the composition of the bat populations. Whenever possible, bats should be removed from those roosts and transported to another location.	1	Range, Study, Bat, Species of Concern	Annual
2. Airfields should be surveyed for potential roosts and bat activity in an effort to minimize BASH issues associated with active bats.	2	Range, Study, Bat, Species of Concern	Annual
3. Coordinate with NDOW, USFWS, BLM, NRCS, and USGS to maintain an accurate inventory of NTTR and NAFB bat species.	2	Range, Study, Bat, Species of Concern	Annual

4.8.1.1.6 References

References Cited

Nellis Air Force Base (NAFB). 1997. Nellis Air Force Base and Range Bat Survey Report. Nellis Air Force Base Environmental Management Directorate Natural Resources.

Additional References

Bechtel Nevada Ecological Services. 1999. Ecological Monitoring and Compliance Program: FY 1999 Report. Las Vegas, Nevada.

Bureau of Land Management. 2003. Nevada Test and Training Range Resource Management Plan and Environmental Impact Statement. 3-26.

Dames and Moore. 1997. Nellis Air Force Range Wetlands Survey Report.

Department of the Air Force. 1999. Renewal of the Nellis Air Force Range Land Withdrawal Legislative Environmental Impact Assessment, Volume 1. 3.8-6 – 3.8-9.

Nellis Air Force Base. 1997. Nellis Air Force Base and Range Bat Survey Report. Nellis Air Force Base, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Water Wells Annex. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Manch Manor Housing Area. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Dunning Circle Housing Area. Nellis AFB, Nevada.

Nevada Environmental Consultants, Inc. 1998. Biological Assessment: Bureau of Land Management Lands Selected for Withdrawal. Nellis Air Force Base, Nevada.

U.S. Army Corps of Engineers, Omaha District. 2001. Environmental Assessment for Live Ordnance Departure Area. Nellis Air Force Base, Nevada.

4.8.1.2 Migratory Birds and Raptors

4.8.1.2.1 Description of Current Conditions

Migratory songbirds and waterfowl can present BASH issues for mission actions and are protected by the Migratory Bird Treaty Act. The Migratory Bird Treaty Act and Executive Order No. 13186, Responsibilities of Federal Agencies to Protect Migratory Birds, January 10, 2001 direct the Air Force to avoid or minimize negative impacts on migratory birds and takes steps to protect birds and restore or enhance their habitat whenever possible. These actions include preventing or evading pollution or detrimental alteration of the environment as practicable within the constraints of the military mission. Also, migratory bird conservation should be incorporated into agency planning processes whenever possible. The USFWS should be notified if unintentional take of migratory birds as a result of Air Force actions is having, or is likely to have, measurable negative impacts on migratory bird populations. Similarly, raptors or birds of prey are not only protected by the Migratory Bird Treaty Act, but also by the Eagle Protection Act. Again, these two acts require the Air Force to minimize or avoid impacts to migratory birds and/or raptors. However, the MBTA exempts the USAF from its requirements when performing official mission duties.

Many species of ducks, geese, and water birds are seasonal migrants in the planning areas and may inhabit playas during wet years. On NTTR, most surface waters are ephemeral and only attract waterfowl during short time periods following storm events. Small populations may inhabit permanent bodies of water located around seeps and springs. In general, the number of waterfowl found in these areas is small and transient. However, mission planners should be cognizant of the fact that temporary bodies of water may attract waterfowl, which could cause damage to low-flying aircraft.

Bird species typically found in sagebrush communities at lower altitudes include the sage thrasher (*Oreoscoptes montanus*), sage sparrow (*Amphispiza belli*), and horned lark (*Eremophila alpestris*). Less frequently observed species include the green-tailed towhee (*Pipilo chlorurus*), mourning dove (*Zenaida macroura*), greater roadrunner, common nighthawk (*Chordeiles minor*), western meadowlark (*Sturnella neglecta*), and common raven (*Corvus corax*). Chukars (*Alectoris chukar)* have been introduced into the area and typically inhabit rocky habitat and desert scrub near freshwater habitat.

The pinyon-juniper woodlands support the greatest bird diversity in the area. Common species include the blue-gray gnat catcher (*Polioptila caerulea*), gray vireo (*Vireo vicinior*), black-throated gray warbler (*Dendroica nigrescens*), juniper titmouse (*Baeolophus ridgwayi*), gray flycatcher (*Empidonax wrightii*), pinyon jays (*Gymnorhinus cyanocephalus*), Townsend's solitaire (*Myadestes townsendi*), and the house finch (*Carpodacus mexicanus*).

Birds present in the Majave Desert creosote scrub plant communities found on much of the South Range and NAFB include the common raven (*Corvus corax*), horned lark (*Eremophila alpestris*), loggerhead shrike (*Lanius ludovicianus*), mourning dove (*Zenaida macroura*), sage

sparrow (*Amphispiza belli*), black-throated sparrow (*Amphispiza bilineata*), burrowing owl (*Athene cunicularia*), greater roadrunner (*Geococcyx californianus*), lesser nighthawk (*Chordeiles acutipennis*), and Gambel's quail (*Callipepla gambelii*). The variety of bird species normally increases where Joshua trees, riparian vegetation, or large cacti are present. The cactus wren (*Campylorhyncus brunneicapillus*) is associated with stands of cholla cactus. Scott's oriole (*Icterus spurius*) are occasionally observed nesting in Joshua trees, and phainopepla (*Phainopepla nitens*), ash-throated flycatcher (*Myiarchus cinerascens*) and blacktailed gnatcatchers *(Polioptila melanura*) are associated with riparian scrub habitat dominated by mesquite (NAFB, 1999).

Horned larks are probably the greatest problem for mission activities, due to the fact that they often congregate near airfields increasing the potential for collision with aircraft. Unfortunately, horned larks often form large flocks that may occupy a single runway. Horned larks are not particularly adapted to desert habitat and require succulent food or surface water for their livelihood. Management of the horned lark can include avoiding accumulations of waters in or near runways.

Raptors are protected by the Migratory Bird Treaty Act and/or the Eagle Protection Act. These species are very important because of their functional role as predator of small mammals, reptiles, and other birds. Some raptors also consume carrion. Field observations indicate that as many as 18 different species of raptors may use the NTTR. Observations from the 1996 survey indicate that raptors inhabiting NTTR for nesting purposes include red-tailed hawks (*Buteo jamaicensis*), golden eagle (*Aquila chrysaetos*), prairie falcons (*Falco mexicanus*), American kestrels (*Falco sparverius*), common barn owls (*Tyto alba*), and the great horned owl (*Bubo virginianus*). Swainson's hawks (*Buteo swainsoni*) and ferruginous hawks (*Buteo regalis)* may also be present across NTTR, but would be expected to be more common in the North Range. Because of their size, raptors can pose serious BASH issues for aircraft.

4.8.1.2.2 Needs Assessment

Need: Although a bird survey was conducted in 1996 in NTTR, current information concerning the composition and distribution of bird populations in NTTR is lacking.

Assessment: This information is not only important from an ecological and environmental standpoint, but should also be determined to avoid or at least minimize BASH issues with aircraft flying through NTTR. Under the proposed BASH Plan (2003), it is stated that the Chief of Safety maintain a current bird activity map for Nellis Ranges and R-2508 and provide any additional information on migratory, local, and seasonal bird activities through contact with the USFWS, Audubon Society, local ornithologists, and other agencies (NAFB, 2003). The fact is that these groups do not have access to NTTR and that any information of this sort must be collected by 99th CES/CEVN. At the very least, surveys should be conducted in areas commonly flown. Raptors probably present the greatest danger to aircraft, and information considering the distribution and nesting sites of raptors is not known.

In 1991, the DoD joined the Partners in Flight (PIF) initiative and is now working in partnership with over 300 federal and state agencies and private wildlife conservation groups to encourage the conservation of Neotropical migratory and residential birds and their habitat. As a part of this partnership, the DoD actively manages its natural resources to support mission needs and flight safety goals while pursuing a sound conservation ethic that strives to benefit bird species throughout the Americas. The DoD PIF program offers a coordinated framework for incorporat-

ing bird habitat management efforts into INRMPs. The strategy focuses on inventory, management, education, and long-term monitoring to determine changes in residential and migrant bird populations on military bases. The DoD's vision is to support the military training and testing mission while being a vital and supportive partner in regional, national, and international bird conservation efforts (DoD, 2002).

Need: If funding is available, NTTR should participate in Partners in Flight Program through HQ A7V. Participation in this program is encouraged and stressed in DoD strategy plans.

Assessment: NTTR is an excellent candidate for locating several sites for visual observation of neotropical migratory birds. Several migratory bird species and raptors use the mountain ranges in NTTR to guide their flight across Nevada. Information is currently available about the routes outside of the boundaries of NTTR, but little is known about the routes once birds cross into NTTR. As cooperative partners with state and federal agencies, NTTR and NAFB should assist in the collection of information inside their boundaries. NTTR and NAFB should also continue working with the Great Basin Bird Observatory to facilitate NTTR's role in preparing the Nevada Bird Atlas.

4.8.1.2.3 Management Goals within the Mission

GOAL 1: To monitor bird populations in NTTR and NAFB, especially in frequently flown areas, to prevent and/or minimize BASH.

GOAL 2: To locate and map raptor nests to avoid BASH issues.

GOAL 3: As part of the Partners in Flight program, assist local and statewide bird survey programs by documenting the locations of bird populations and observations and by sharing information with the Great Basin Bird Observatory.

4.8.1.2.4 Management Guidelines

The military mission always takes precedence over the guidelines recommended in the INRMP. Managers should adhere to the guidelines within the constraints of the mission.

During the planning or implementation of any mission action, 99th CES should be consulted to determine the following:

- **Whether flight paths used by aircraft traverse areas where birds, raptors, or waterfowl may present a problem. If information is not available, 99th CES should survey the area to determine presence of any habitat that would be conducive to nesting or foraging by significant populations of birds.**
- **Proposed mission actions should also be reviewed to determine if they will impact nesting areas of raptors. These birds are protected under the Migratory Bird Act and possibly the Eagle Protection Act.**
- **All projects should be reviewed for potential impacts to raptor nests and compliance with the Eagle Protection Act and the Migratory Bird Act.**

99th CES should encourage participation of NTTR in the Great Basin Bird Observatory and Partners in Flight by collecting information on birds in NTTR during other surveys and projects and by sharing that information with the public.

4.8.1.2.5 Projects

Project	Goal	Project No.	Due Date
1. Areas commonly used for flight paths and maneuvers by the mission should be surveyed to determine if raptors, waterfowl, and other avian species are present in significant numbers to cause BASH issues for those planes.	1,2	Range, Migratory/Neotropical Bird Surveys and Evaluations	Annual
2. Survey riparian, mountain, and other suitable habitat for use by migratory birds and raptors to develop an inventory of birds found on NTTR and NAFB. Inventories will also assist in identifying any migrating rare, threatened and endangered species in any of these areas.	3	Range, Migratory/Neotropical Bird Surveys and Evaluations	Annual
3. Identify the bird migration corridors through the NTTR. These corridors would be areas with high BASH risk and places where construction of towers should be avoided or minimized to reduce likelihood of birds striking the towers.	1	Range, Migratory/Neotropical Bird Surveys and Evaluations	Annual
3. Qualified biologist surveying or conducting projects within NTTR should always note the location and species of raptors or raptor nests observed. This information should be noted on maps and incorporated into the natural resource database. Additionally, any observations of waterfowl and other birds should also be noted and incorporated into the database. Over time, this information will provide excellent baseline for determining potential dangerous areas for flight paths.	3	Range, Migratory/Neotropical Bird Surveys and Evaluations	Annual

4.8.1.2.6 References

Literature Cited

Bureau of Land Management. 2003. Nevada Test and Training Range Resource Management Plan and Environmental Impact Statement. 3-26.

Department of the Air Force. 1999. Renewal of the Nellis Air Force Range Land Withdrawal Legislative Environmental Impact Assessment, Volume 1. 3.8-6 – 3.8-9.

Department of Defense. 2002. Department of Defense Partners in Flight Strategic Plan. From the Message of Support by Assistant Deputy Under Secretary of Defense John Paul Woodley, Jr.

Nellis Air Force Base. 1994. Final Report of Biological Study in Area II of Nellis Air Force Base.

Nellis Air Force Base. 1999. Renewal of the Nellis Air Force Range Land Withdrawal. Department of the Air Force Legislative Environmental Impact Statement.

Nellis Air Force Base. 2003. Draft Bird-Aircraft Strike Hazard Plan.

U.S. Department of the Air Force. 1997. Bird Survey Report. Summary of Bird Surveys, Nellis Air Force Range. January 1996-October 1996.

Additional References

Dames & Moore, Inc. 1996. Biological Resources Technical Memorandum. Environmental Assessment: Regional Training Area, Indian Springs Air Force Auxiliary Field. Nellis Air Force Base, Nevada.

Bechtel Nevada Ecological Services. 2002. Ecological Monitoring and Compliance Program Fiscal Year 2002 Report. Las Vegas, Nevada.

Nature Conservancy. 2000. Ecoregion-Based Conservation in the Mojave Desert with a Contextual Analysis for Nellis Air Force Base and Ranges: Volumes I and II.

Nellis Air Force Base. 1997. Bird Survey Report. Air Force Project No. RKXF956145. Nellis AFB and Nellis Air Force Range, Nevada.

Nevada Environmental Consultants, Inc. 1998. Biological Assessment: Bureau of Land Management Lands Selected for Withdrawal. Nellis Air Force Base, Nevada.

U.S. Department of the Air Force. 1996. Summary of Bird Surveys: Nellis Air Force Range. Nellis AFB, Nevada.

United States Department of the Air Force. 1994. Final Report of Fall and Winter Surveys for Nine Wildlife Species on Nellis Air Force Base Area II. Nellis Air Force Base, Nevada.

SWCA, Inc. 1991. Biological Assessment for Mojave Desert Tortoise. Clark County, Nevada.

4.8.1.3 Reptiles and Amphibians

4.8.1.3.1 Description of Current Conditions.

Reptiles are common across the entire NTTR and NAFB, while amphibians are scarce and only found in areas containing perennial sources of water. The most common amphibians found in NTTR are the Great Basin spade-foot toad (*Scaphiopus intermontanus*) on the North Range and the western spade-foot toad (*Scaphiopus hammondi*) and the western toad (*Bufo boreas*) on the South Range. Reptiles are less abundant in the North Range, probably due to the colder climate. Common reptiles found in NTTR include the desert tortoise (*Gopherus agassizii*), banded Gbanded Gila monster (*Heloderma suspectum cinctum*), side-blotched lizard (*Uta stansburiana*), California whiptail (*Cnemidophorous tigris*), zebra-tailed lizard (*Callisaurus draconoides*), desert spiny lizard (*Sceloporus magister*), desert night lizard (*Xanthusia vigilis*), chuckwalla lizard (*Sauromalus obesus*), and the desert horned lizard (*Phyrnosoma platyrhinos*). Common snakes include the coach whip (*Masticophis flagellum*), western patch-nosed snake

(*Salvadora hexalepis*), gopher snake (*Pituophis melanoleucus*), western shovel-nosed snake (*Chionactis occipitalis*), and the Mojave rattlesnake (*Carotalus Scultulatus*). On the North Range, additional reptile species have been observed and include the sagebrush lizard (*Sceloporus graciosus*), Long-nosed leopard lizard (*Gambelia wisilenii*), Great Basin rattlesnake (*Crotalus viridis luteosus*), and Hopi rattlesnake (*C.v. nuntius*).

Very little is known about the distribution and composition of reptiles and amphibians on NTTR. This information is important in identifying potentially rare or endangered species, as well as developing a broader understanding of the ecosystem in NTTR.

4.8.1.3.2 Needs Assessment

Need: Surveys to identify and determine the distribution of reptiles and amphibians in NTTR and NAFB are needed.

Assessment: At the present time, very little information is available on the species composition of amphibians and reptiles on NTTR and NAFB. In addition, the distribution of the species across the area is unknown. Information should be collected to identify the presence of any species of concern and to assist in maintaining a productive and healthy ecosystem.

4.8.1.3.3 Management Goals within the Mission

GOAL 1: Minimize or avoid impacts to reptiles and amphibians on NTTR and NAFB.

GOAL 2: Inventory the species of reptiles and amphibians inhabiting NTTR and NAFB.

4.8.1.3.4 Management Guidelines

The military mission always takes precedence over the guidelines recommended in the INRMP. Managers should adhere to the guidelines within the constraints of the mission.

Prior to the implementation and planning of any construction activity on NTTR, the site should be surveyed to determine the presence of any reptiles and amphibians. The species and location should be identified and recorded in the natural resource database. If possible, construction plans should be altered to avoid impacts to any rare or uncommon reptile species. The NDOW protocol for protection of the banded Gila monster should be implemented when possible.

During any other surveys or projects, biologists and other qualified personnel should document the location and species of any reptiles and amphibians observed. This information should be entered into the natural resource database.

4.8.1.3.5 Projects

Project	Goal	Project No.	Due Date
1. During any projects or surveys conducted by qualified biologists, the species and location of observed amphibians or reptiles should be recorded and entered into the natural resource database.	1,2	Range, GIS Database and Aerial Photography	Annual
2. Past information concerning locations of reptiles and amphibians should also be incorporated into the natural resources database. In addition, a standard protocol should be developed for entering proper information concerning reptilian and amphibious species in the natural resource database.	2	Range, GIS Database and Aerial Photography	Annual
3. During the surveys, if any candidate species are identified, additional surveys should be conducted to determine their distribution on NAFB and NTTR.	2	Candidate Species Survey—Monitor Distribution	Annual

4.8.1.3.6 References

Bureau of Land Management. 2003. Nevada Test and Training Range Resource Management Plan and Environmental Impact Statement. 3-26.

Dames & Moore. 1994. Herpetological Study in the Indian Springs Valley and Three Lakes Valley, Nellis Air Force Range. Nellis AFB, Nevada.

Dames & Moore. 1994. Biological Assessment of the Proposed CBU Target Site at the Nellis Air Force Range. Nellis AFB, Nevada.

Dames & Moore, Inc. 1996. Biological Resources Technical Memorandum. Environmental Assessment: Regional Training Area, Indian Springs Air Force Auxiliary Field. Nellis Air Force Base, Nevada.

Department of the Air Force. 1999. Renewal of the Nellis Air Force Range Land Withdrawal Legislative Environmental Impact Assessment, Volume 1. 3.8-6 – 3.8-9.

Nature Conservancy. 2000. Ecoregion-Based Conservation in the Mojave Desert with a Contextual Analysis for Nellis Air Force Base and Ranges: Volumes I and II.

Nevada Environmental Consultants, Inc. 1998. Biological Assessment: Bureau of Land Management Lands Selected for Withdrawal. Nellis Air Force Base, Nevada.

United States Department of the Air Force. 1994. Final Report of Fall and Winter Surveys for Nine Wildlife Species on Nellis Air Force Base Area II. Nellis Air Force Base, Nevada.

4.8.1.4 Small Mammals

4.8.1.4.1 Description of Current Conditions

Small mammal trap used in a survey on the North Range.

Common small mammals found in NTTR and NAFB include the following:

- Coyote (*Canis latrans*)
- Badger (*Taxisdea taxus*)
- Black-tailed jackrabbit (*Lepus californicus*)
- Desert kit fox (*Vulpes macrotis*)
- Bobcat (*Lynx rufus*)
- Red fox (*Vulpes fulva*)
- Gray fox (*Urocyon cinereoargenteus*)

In addition to these larger species, smaller mammals and rodents are a very common component across NTTR. Other than the surveys conducted by Dr. David J. Hafner on the kangaroo rats on sand dune areas of the North Range, no quantitative studies have been conducted to identify the species present or the ecological parameters of small mammals. Small mammals serve important functions in the ecology of the desert, providing food sources for carnivores, and facilitating seed germination, seedling establishment, mixing of soils, and enhancement of nutrient cycling.

4.8.1.4.2 Needs Assessment

Measuring various characteristics of a small mammal.

Need: Surveys to identify and determine the distribution of small mammals at NTTR and NAFB should be conducted.

Assessment: With the exception of one informal survey conducted at NAFB identifying mammals present in Area II, very little information has been collected concerning the distribution of small mammals across NTTR and NAFB. This information is vital for development of a well-balanced ecosystem and for detecting any species of concern.

4.8.1.4.3 Management Goals within the Mission

GOAL 1: To minimize or avoid impacts to established populations of mammals on NTTR and NAFB.

GOAL 2: To develop a better understanding of the ecological function and distribution of various mammals found on NTTR and NAFB.

4.8.1.4.4 Management Guidelines

The military mission always takes precedence over the guidelines recommended in the INRMP. Managers should adhere to the guidelines within the constraints of the mission.

- **Prior to the implementation of any construction project, the project site should be surveyed to determine the presence of any small mammals. If possible, direct impacts to these mammalian populations should be minimized or avoided.**
- **Small mammal surveys should be conducted to gain a better understanding of the NTTR and NAFB ecosystems and to determine if any species could be used as indicators for determining the overall health of the ecosystem.**

4.8.1.4.5 Projects

Project	Goal	Project No.	Due Date
1. Whenever possible, biologists conducting projects or surveys at NAFB or NTTR should record location and species of any small mammals observed. This information should be recorded and incorporated into the natural resource database. Such information will be especially helpful in providing information to NDOW and the USFWS concerning the distribution and ecological function of mammals in southern Nevada and for the identification of indicator species to be used in future natural resource management of the area.	2	Survey, Evaluate Distribution of Wildlife/Species at Risk	Annual
2. Delineate a minimum of 20 sampling sites across NTTR and 4 sampling sites on NAFB to conduct small mammal live trap surveys to assist in determining the health of the overall ecosystem. Number of sites or location may be changed each year, but surveys will be conducted on a continuing basis.	1,2	Survey, Evaluate Distribution of Wildlife/Species at Risk	Annual
3. Conduct annual surveys for small mammals with an emphasis on riparian areas, seeps, springs, and other habitats to evaluate and determine the seasonal distribution of small mammals in NTTR and NAFB.	1,2	Survey, Evaluate Distribution of Wildlife/Species at Risk	Annual

4.8.1.4.6 References

Dames & Moore. 1994. Biological Assessment of the Proposed CBU Target Site at the Nellis Air Force Range. Nellis AFB, Nevada.

Dames & Moore, Inc. 1996. Biological Resources Technical Memorandum. Environmental Assessment: Regional Training Area, Indian Springs Air Force Auxiliary Field.

Nellis Air Force Base. 1994. Final Report of Biological Study in Area II of Nellis Air Force Base.

Nevada Environmental Consultants, Inc. 1998. Biological Assessment: Bureau of Land Management Lands Selected for Withdrawal. Nellis Air Force Base, Nevada.

SWCA, Inc. 1991. Biological Assessment for Mojave Desert Tortoise. Clark County, Nevada.

United States Department of the Air Force. 1994. Final Report of Fall and Winter Surveys for Nine Wildlife Species on Nellis Air Force Base Area II. Nellis Air Force Base, Nevada.

4.8.1.5 Wild Horses

4.8.1.5.1 Description of Current Conditions

Throughout the past two hundred years, ranchers, miners, and other settlers have released horses (*Equus caballus*) into the western states, including Nevada. These horses multiplied and continue to endure in the north-central portion of NTTR.

In 1962, the U.S. Air Force and the Bureau of Land Management worked together and agreed to create the Nevada Wild Horse Range (NWHR) on the north-central portion of the NAFR and the BLM was given the task of managing it. In 1972, Public Law 92-195, the Wild Free-Roaming Horse and Burro Act was created to protect the horses on the NWHR, and the Cooperative Agreement between the BLM and USAF in 1974 (Appendix B of the ROD for the BLM Range Management Plan) gave the BLM the responsibility of conducting annual censuses of the horses and determining the condition of vegetative resources. In 1977, approximately 800 horses roamed the NWHR; however, since that time, the population has increased substantially, reaching a peak of approximately 10,000 wild horses in 1993 (Science Applications International, 1999).

Because of concerns regarding overpopulation and over-grazing of wild horses, the *Nevada Wild Horse Range Herd Management Plan* established an Appropriate Management Level (AML) of 2,000 wild horses on the NWHR in 1989. This AML was to be determined by the amount of forage and water available to the horses, as monitored annually by the BLM, and consequently would be expected to vary occasionally. The most recent AML was set by the Record of Decision for the NTTR Resource Management Plan EIS (U.S. Dept. of Interior, 2004a) in 2004 and determined to be 300-500 horses. These AMLs, which have yet to be reached, are maintained by the BLM through horse gathers conducted cooperatively with the USAF. In 1998, after numerous wild horse gathers took place, a total of 820 horses remained on the NWHR (U.S. Dept. of Interior, 2004). Another series of gathers were conducted in December 2003 during which 1,100 horses were removed, reducing the herd population to approximately 500 horses. In 2005, a total of 880 horses were censured on NTTR (BLM, 2005).

Wild horses alter vegetation composition and production where they graze and compete with native species such as mule deer, pronghorn, and bighorn sheep, for water and vegetation. An extreme example of the potential negative impacts of grazing may be seen in the Kawich Valley. Where wild horses are present in this area, the Great Basin scrub vegetation has been uniformly cropped over many acres to less than 8 in high. It is clear that the closely cropped plants

in the Kawich Valley do not represent the condition of the vegetation before the horses were introduced. BLM established fenced exclosures on Cactus Flats and in other areas to observe forage utilization, but has not documented impacts from wild horses to date. On the Tonopah Test Range, DOE has fenced areas that prevent grazing by wild horses. These excluded areas have re-grown with abundant native vegetation, which is not impacted by grazing of wild horses. This provides another opportunity for monitoring the intensity of grazing by the horses. To improve the measurement of wild horse impacts to vegetation, more exclosures should be implemented in random sites across the North Range.

Wild horses have historically established themselves around water sources, and when populations are high, upland vegetation has been impacted for 8-10 miles from accessible water. The Dames and Moore Report (1997) cited wild horses as the sources for degradation at springs and seeps on the NTTR. As a result, some seeps and springs outside the NWHR have been fenced by the USAF to prevent grazing, subsequently allowing the vegetation to improve and become habitable for other types of wildlife. However, the BLM has directed that fencing on the NWHR be used "only when monitoring demonstrates that other management projects are not successful in achieving . . . a thriving ecological balance consistent with other resource values" (U.S. Dept. of Interior, 2001). In the future, it is recommended that the BLM continue annual censuses of the wild horse population and to conduct wild horse gathers as necessary to maintain the current AML for the NWHR of 300 to 500 horses. The final ROD for the BLM NTTR Resource Management Plan EIS (U.S. Dept. of Interior, 2004a) stated that the BLM is required to:

- "Implement measures to protect riparian areas, such as fences and/or alternate water sources away from the riparian area."
- "Limit forage utilization by all herbivores to 50 percent of the current year's above-ground primary production or key grasses, and 45 percent for key shrubs and forbs. Construct up to seven exclosures to help assess resource conditions."

The final Resource Management Plan prepared by the BLM for NTTR lands revised the 1971 wild horse herd management area (HMA) to include the entire North Range, encompassing approximately 1,330,540 acres. Within the HMA, the BLM proposed to use a core area of 474,370 acres within which to calculate the AML for the entire HMA. This will not impact the mission to a great extent, since the USAF mission still has precedence over BLM management. However, it does require a cooperative effort between USAF and BLM.

4.8.1.5.2 Needs Assessment

Need: According to the Record of Decision for the BLM RMP EIS, BLM is encouraged to construct up to seven exclosures to be used to monitor forage utilization by wild horses and burros (BLM, 2004).

Assessment: Information collected from monitoring of exclosures is highly critical in determining the AML for the area and absolutely necessary to properly manage the horses in an effort to minimize adverse impacts to plants and wildlife in the area. The Natural Resources Program should encourage the BLM to accomplish this goal and assist in the monitoring of exclosures when possible.

Need: The location of herds and herd movement has not been well-documented and should be entered into the natural resource database both from historical and current occurrence. BLM can provide USAF with a copy of the flight map completed during the last census; however, wild horses move and do not stay in one location. Moreover, horses are not managed by the BLM

once they leave the Herd Management Area. BLM has limited ability to know the daily locations of wild horses.

Assessment: This information is vital to the mission because the Wild Free-Roaming Horse and Burrow Act (PL 92-195) states the following:

> ***It is the policy of Congress that wild free-roaming horses and burros shall be protected from capture, branding, harassment, or death; and to accomplish this they are to be considered in the area where presently found, as***

4.8.1.5.5 Projects

Project	Goal	Project No.	Due Date
1. Set up utilization cages within the wild horse exclosures to monitor antelope and mule deer range use.	1	Survey, Evaluate Distribution of Wildlife/Species at Risk	June 2008
2. Evaluate the level of range use within and outside of the mule deer/antelope utilization cages and the wild horse exclosures on a quarterly basis to determine range use by large mammals and wild horses.	1	Survey, Evaluate Distribution of Wildlife/Species at Risk	Annual

4.8.1.5.6 References

Literature Cited

Dames and Moore. 1997. Nellis Air Force Range Wetlands Survey Report.

Dept. of the Air Force. 1999. *Renewal of the Nellis Air Force Range Land Withdrawal*. 3.8-32, 3.8-33.

Science Applications International Corporation. 1999. Final Report: Range Condition Survey and Appropriate Management Level of Wild Horses on the Nevada Wild Horse Range, Nye County, Nevada.

U.S. Dept. of the Interior, Bureau of Land Management, Nevada State Office. 2001. Draft *Nevada Test & Training Range Resource Management Plan and Environmental Impact Statement*.

U.S. Dept. of the Interior, Bureau of Land Management, Nevada State Office. 2004. *Nevada Test & Training Range Resource Management Plan and Environmental Impact Statement*.

U.S. Dept. of the Interior, Bureau of Land Management, Nevada State Office. 2004a. Record of Decision for the *Nevada Test & Training Range Resource Management Plan and Environmental Impact Statement*.

Additional References

Bechtel Nevada Ecological Services. 1999. *Ecological Monitoring and Compliance Program – Fiscal Year 1999 Report*.

Bectel Nevada Ecological Services. 2002. *Ecological Monitoring and Compliance Program – Fiscal Year 2002 Report*.

Department of the Air Force. 1999. Renewal of the Nellis Air Force Range Land Withdrawal Legislative Environmental Impact Statement. Nellis AFB, Nevada.

United States Department of the Interior, Bureau of Land Management, Las Vegas District. 1992. Nellis Air Force Range Resource Plan and Record of Decision. Nellis Air Force Base, Nevada.

4.8.2 Large Mammals

Habitat preferred by mule deer in the Kawich Range.

4.8.2.1 Description of Current Conditions

Mule deer, antelope, desert bighorn, and mountain lions are prominent large mammal species found on NTTR. Mule deer, antelope, and desert bighorn serve as good indicators of range conditions on NTTR. If they are maintaining or increasing their population size, expanding their distribution, and are individually maintaining themselves in good health, it is likely that the local ecosystem is in good condition. Black bear and mountain lions are rare on NTTR, but play an important role as predators of other large and small mammals.

In general, mule deer reside in the mountain ranges throughout NTTR year-round. However, census data concerning mule deer is completely lacking at this time. It appears that deer may move between mountain ranges, but no regular migration pattern has been documented (USAF, 1985). Poor water distribution during the summer and lack of cover appears to limit deer use during the winter and spring. Mule deer prefer areas that have hiding cover, and, therefore, are not commonly found in valley locations and in the southern Range area. Preferred habitat by mule deer includes open woodlands with an understory of big sage, black sagebrush, bitter brush, and cliff rose. The deer appear to prefer mountains over valleys.

Herd of pronghorn antelope on Cactus Flat in the North Range.

A conspicuous member of the wild fauna of the North Range is the pronghorn antelope, an animal unique to North America. Pronghorn populations appear to be highest where water sources

Small herd of Desert Bighorn Sheep near Stonewalll Mountain on the North Range.

are less than 1-2 miles apart, but they have been shown to travel over five miles for water. The pronghorn diet is usually palatable forbs in the spring and summer and shrubs in the summer and winter. They eat a variety of forbs, grasses, and shrubs, but favor sagebrush on the North Range. Due to this preference, they can be seen regularly on the east side of Cactus Flat on the North Range during morning hours and before sunset, in areas where sagebrush and other perennial forage items are present. They can travel 3 miles or more from the nearest source of surface water. Breeding occurs between late July and early October.

Very little information has been gathered in recent years concerning pronghorn populations and the location of pronghorn herds at NTTR. Although their population was in decline on the North Range in the early 1990s, pronghorn have apparently increased by 1996 with the reduction in the wild horse population (A. Shepherd, BLM, 1996, personal communication). Recently, one pronghorn antelope was observed in the South Range, which may indicate that their range is expanding (R. Turner. 99th CES/CEVN, 2004, Personal communication). Unlike deer, pronghorn antelope prefer open, short-grass ranges with scattered brush. Hiding cover does not appear to be an important component of pronghorn habitat. On NTTR, pronghorn antelope are year-round residents in all or part of Cactus Flat, Kawich Valley, Sand Springs Valley, and Immigrant Valley.

Populations of desert bighorn sheep are found in and around the mountainous portions of the South Range and around Stonewall Mountain and the east side of Pahute Mesa and Cactus Range on the North Range. They favor higher elevations in the summer and lower elevations in the winter. Mean body weights range from 290-320 lb. In males, more than 10% of the body weight may be in the head because of the large, curved horns (Lawson and Johnson, 1982). Hunting for this species is permitted for 15 days in December through January on the South Range in the Spotted and Pintwater ranges, and for 3 weeks in November on the North Range at Stonewall Mountain. Tags are awarded through a draw conducted by the Nevada Division of Wildlife (NDOW). The sheep tend to travel in herds of 5 to 30 animals, with grazing areas up to 12 miles in diameter, centered around water sources. The mating season, or rut, reaches a peak in August or September. Lambs are usually born singly in the spring (Lawson and Johnson, 1982).

NDOW also actively participates in desert bighorn management. On the NTTR, the Air Force cooperates with NDOW and USFWS by permitting and facilitating an annual winter hunt by permitted individuals for desert bighorns. NDOW and the USFWS cooperatively conduct annual surveys of the desert bighorn sheep in the South Range and biannual surveys on the North Range. This information is available for review and can be incorporated into the natural resource database. Natural resource and other NAFB personnel will consider this resource when

manager should be consulted concerning the following:

- **The location of mission actions with respect to mule deer, antelope, and bighorn sheep herds. Actions to be located in areas frequented by large game herds should be modified if at all possible to decrease potential safety issues and prevent impacts to the herds as required by state game laws.**
- **If the mission action cannot be modified to avoid direct impact of herds, military personnel should be warned that the herds are present and could cause problems with vehicle collisions**

- **During any helicopter or aerial survey, all types of wildlife observed should be recorded in an effort to take advantage of air time and access time on NTTR. Helicopter surveys can be especially helpful for sighting of raptors, mountain lions, sage grouse, and other species. This information is critical, not only to the monitoring and well-being of the ecosystem, but also for the safety of the mission.**
- **99th CES/CEVN should be notified if any Air Force personnel who finds a dead or diseased bighorn sheep, mule deer, antelope, or mountain lion. NDOW and USFWS will subsequently be notified.**

4.8.2.5 Projects

Project	Goal	Project No.	Due Date
1. Annual desert bighorn sheep surveys should be continued in cooperation with NDOW in the Stonewall Mountain, Pahute Mesa, Tolicha Peak/Quartz Mountain/Thirsty Canyon, Cactus Range, Spotted Range, Pintwater Range, Desert Range, Pahranagat Range, and the East Desert Range. These surveys will provide baseline data for management considerations, such as population characteristics, status, migration and trends.	1,2	Survey, Evaluate Distribution of Wildlife/Species at Risk	Annual
2. Mule deer should be inventoried in the Belted Range, Kawich Range, Stonewall Mountain, Pahute Mesa, and Groom Range. Surveys could be conducted in cooperation with NDOW. During the surveys, locations and movements of other large game and wildlife/raptors could be conducted. These surveys will provide baseline data for management considerations, such as population characteristics, status, migration, and trends.	1,2	Survey, Evaluate Distribution of Wildlife/Species at Risk	Annual
3. Pronghorn antelope should be surveyed in Kawich Valley, Cactus Flat, Reveille Valley, Gold Flat, and Pahute Mesa. These surveys could be conducted between NDOW and USAF. Antelope surveys should be conducted at least every two years. These surveys will provide baseline data for management considerations, such as population characteristics, status, migration, and trends.	1,2	Survey, Evaluate Distribution of Wildlife/Species at Risk	Annual
4. Mule deer, pronghorn antelope, and bighorn sheep surveys can be accomplished jointly with NDOW to provide for more efficient use of funding and labor. These surveys should be carefully planned to allow for proper access and use of helicopters or fixed-wing aircraft. If possible, the same survey crew of qualified biologists should be used to conduct the surveys to provide consistency in data collection and results.	1,2	Survey, Evaluate Distribution of Wildlife/Species at Risk	Annual

Project	Goal	Project No.	Due Date
5. Develop close communication and cooperation with USFWS and NDOW for the monitoring of large game and other wildlife. Beginning in January of 2005, these agencies should develop standard protocols and open communications for surveying wildlife on NTTR.	1,2	Survey, Evaluate Distribution of Wildlife/Species at Risk	Annual

4.8.2.6 References

Literature Cited

Bighorn Sheep Surveys and Hunts, NAFR.

Department of the Air Force. 1999. Renewal of the Nellis Air Force Range Land Withdrawal Legislative Environmental Impact Statement. Nellis AFB, Nevada.

Lawson, B., and R. Johnson. 1982. Mountain Sheep: *Ovis canadensis* and *O. dalli*, pp. 1036-1055, In V. A. Chapman and G. A. Feldhamer, eds. *Wild Mammals of North America: Biology, Management and Economics.* The Johns Hopkins University Press, Baltimore.

Results of Pronghorn Antelope Surveys and Hunts on the NAFR.

United States Air Force (USAF). 1985. Draft Environmental Impact Statement. Groom Mountain Range, Lincoln County, Nevada. Nellis Air Force Base, Nevada.

Additional References

Bechtel Nevada Ecological Services. 1999. Ecological Monitoring and Compliance Program: FY 1999 Report. Las Vegas, Nevada.

Miscellaneous Notes about Pronghorn Management.

Mule Deer Surveys and Hunts Reports.

United States Air Force. 2003. Bighorn Sheep Hunt Stonewall Mountain. Project Support Plan. Nellis Air Force Base, Nevada.

United States Air Force. 2003. Range Safety Assessment for Bighorn Sheep Hunt, Change 1. Nellis Air Force Base, Nevada.

United States Air Force. 2003-2004. Bighorn Sheep Hunt Southern Ranges Project Support Plan. Nellis Air Force Base, Nevada.

4.9 THREATENED AND ENDANGERED SPECIES

The Endangered Species Act of 1973, as amended (ESA), is administered by the USFWS and provides for the protection of plants and animals that are in danger of becoming extinct. ESA was established to provide a means whereby the ecosystems upon which endangered and threatened species depend may be conserved. The ESA requires that all Federal agencies shall seek to conserve endangered and threatened species and shall utilize their authorities to further the purpose of this Act. During 1995 and 1996, USFWS was directed by Congress to assess the legal protection levels provided by the ESA. The evaluation process led to a set of new protection policies for rare plants and animals in the United States. The current protection status for these species are reviewed in detail in Federal Register announcements of February 28 and December 5, 1996.

Prior to February 28, 1996, USFWS maintained a list of candidate species for listing under the ESA designated as “C1" and “C2" candidate species. The February 28, 1996 Federal Register announcement directed that C1 species would become simply “candidate species” for listing, and C2 species would now be designated “species of concern.” In the December 5, 1996 Federal Participation by the USFWS in partnerships with other agencies and conservation organizations revised the February 28 protocol by announcing that only lists of endangered and threatened species would be provided.

Prior to 1996, the USFWS maintained a list of approximately 4,000 “candidate” species under three separate categories. On February 28, 1996, the USFWS published a revised candidate list that eliminated the categories and included only species for which sufficient information was available to support a listing proposal under the ESA (61 FR 7595). The revisions to the candidate list were intended to strengthen the scientific basis of the endangered species program and reduced the number of candidate species to 182. Currently, the USFWS has the following statistics for endangered and threatened species:

- 518 U.S. species of animals are listed.
- 746 U.S. species of plants are listed.
- 21 U.S. species of animals are currently proposed for listing.
- 143 species of animals are candidate species.
- 143 species of plants are candidate species.

Individual states maintain a list of species of concern, a category for which there is no legal protection under the ESA.

The Air Force has been in Section 7 consultation with the USFWS under ESA for several projects that potentially impacted the Desert Tortoise. Biological assessments (BA) and biological opinions (BO) have been prepared for these projects and are included in the reference list for the desert tortoise. These BO have set a precedent for desert tortoise management on NTTR and NAFB.

The Nevada Revised Statutes and Nevada Administrative Code establish the following management classifications for the plants and wildlife species in the state:

- game
- furbearer
- protected
- threatened
- rare

- species of concern
- endangered for animals
- critically endangered for plants

NAC 503.030-503.080 identifies the species listed in these categories for animals and NAC 527.010 includes the list of plant species that the state forester has declared to be critically endangered and threatened with extinction. All of the species on these lists are considered in developing the INRMP.

Under the Sikes Act, it is Air Force policy to conserve species and habitats wherever possible. Therefore, for the purposes of natural resources conservation and the INRMP, 99th CES describes sensitive species as those warranting more vigorous conservation and, in some cases, study, until enough information is available regarding their required level of conservation. If and when species are formally removed from all lists, such as USFWS threatened, endangered, and candidate lists, TNC's state and global rarity list, or BLM's sensitive species list, those species will no longer be actively singled out for specific management actions. Until that time, species on these lists will be accorded management conservation as sensitive species. Wherever possible, impacts to these species will be avoided and minimized and their habitats will be managed. In the tables below are listed endangered and threatened species and species of concern that could potentially be found in NAFB or NTTR.

TABLE 4-4.
State and Federal Listed Reptile and Amphibian Species of Concern Potentially Found on NTTR and NAFB.

COMMON NAME	SCIENTIFIC NAME	STATUS	
		NATIONAL	STATE
REPTILES			
Common Chuckwalla	*Sauromalus obesus*	SoC	Sensitive
Short-Horned Lizard	*Phrynosoma douglasii*	Unlisted	Sensitive
Banded Gila monster	*Heloderma suspectum cinctum*	SoC	Special
Desert Tortoise	*Gopherus agassizii*	Threatened	Special
AMPHIBIANS			
Relict Leopard Frog	*Rana onca*	Candidate	Special
Northern Leopard Frog	*Rana pipiens*	Unlisted	Sensitive
Columbia Spotted Frog	*Rana luteiventris pop*	Candidate	Special
Amargosa Toad	*Bufo nelsoni*	Unlisted	Sensitive
Arizona (southwestern) Toad	*Bufo microscaphus microscaphus*	Unlisted	Sensitive

TABLE 4-5
State and Federal Listed Bird Species of Concern Potentially Found on NTTR and NAFB.

COMMON NAME	SCIENTIFIC NAME	STATUS	
		NATIONAL	STATE
Western Least Bittern	*Ixobrychus exilis hesperis*	SoC	Sensitive
Yellow-Breasted Chat	*Icteria virens*	Unlisted	Sensitive
Greater Sandhill Crane	*Grus candensis tabida*	Unlisted	Sensitive
Western Yellow-Billed Cuckoo	*Coccyzus americanus occidentalis*	Candidate	Special
Long-Billed Curlew	*Numenius americanus*	Unlisted	Sensitive
Bald Eagle	*Haliaeetus leucocephalus*	Threatened	Endangered
Golden Eagle	*Aquila chrysaetos*	Unlisted	Sensitive
Peregrine Falcon	*Falco peregrinus*	Endangered	Special
Prairie Falcon	*Falco mexicanus*	Unlisted	Sensitive
Black Rosy-Finch	*Leucosticte atrata*	Unlisted	Sensitive
Southwestern Willow Fly-catcher	*Empidonax traillii extimus*	Endangered	Special
Northern Goshawk	*Accipiter gentilis*	SoC	Sensitive
Ferruginous Hawk	*Buteo regalis*	SoC	Sensitive
Swainson's Hawk	*Buteo swainsoni*	Unlisted	Sensitive
White-Faced Ibis	*Plegadis chihi*	SoC	Protected
Pinyon Jay	*Gymnorhinus cyanocephalus*	Unlisted	Sensitive
Osprey	*Pandion haliaetus*	Unlisted	Protected
Flammulated Owl	*Otus flammeolus*	Sensitive (USFS)	Sensitive
Long-Eared Owl	*Asio otus*	Unlisted	Protected
Western Burrowing Owl	*Athene cunicularia hypugaea*	SoC	Sensitive
Phainopepla	*Phainopepla nitens*	Unlisted	Sensitive
Mountain Plover	*Charadrius montanus*	Proposed Threatened	Sensitive
Western Snowy Plover	*Charadrius alexandrinus nivosus*	Threatened	Sensitive
Yuma Clapper Rail	*Rallus longirostris yumanensis*	Endangered	Unlisted
Red-Naped Sapsucker	*Sphyrapicus nuchalis*	Unlisted	Sensitive
Loggerhead Shrike	*Lanius ludovicianus*	SoC	Sensitive
Vesper Sparrow	*Pooecetes gramineus*	Unlisted	Sensitive
Wood Stork	*Mycteria americana*	Endangered	Special

COMMON NAME	SCIENTIFIC NAME	STATUS	
		NATIONAL	STATE
Black Tern	*Chlidonias niger*	SoC	Sensitive
Least Tern	*Sterna antillarum*	Endangered	Special
Crissal Thrasher	*Toxostoma crissale*	Unlisted	Sensitive
Le Conte's Thrasher	*Toxostoma lecontei*	Unlisted	Sensitive
Juniper Titmouse	*Baelophus griseus*	Unlisted	Sensitive
Gray Vireo	*Vireo vicinior*	Unlisted	Sensitive
Lucy's Warbler	*Vermivora luciae*	Unlisted	Sensitive
Macgillivray's Warbler	*Oporornis tolmiei*	Unlisted	Protected
Orange-Crowned Warbler	*Vermivora celata*	Unlisted	Protected
Yellow Warbler	*Dendroica petechia*	Unlisted	Protected
Lewis' Woodpecker	*Melanerpes lewis*	Unlisted	Sensitive
Common Yellowthroat	*Geothylpis trichas*	Unlisted	Protected

TABLE 4-6
State and Federal Listed Mammal Species of Concern Potentially Found on NTTR and NAFB.

COMMON NAME	SCIENTIFIC NAME	STATUS	
		NATIONAL	STATE
Allen's Big-Eared Bat	*Idionycteris phyllotis*	SoC	Sensitive
Big Free-Tailed Bat	*Nyctinomops macrotis*	SoC	Sensitive
Brazilian Free-Tailed Bat	*Tadarida brasiliensis*	Unlisted	Sensitive
California Leaf-Nosed Bat	*Macrotus californicus*	SoC	Sensitive
Greater Western Mastiff Bat	*Eumops perotis californicus*	SoC	Sensitive
Hoary Bat	*Lasiurus cinereus*	Unlisted	Sensitive
Mexican Long-Tongued Bat	*Choeronycteris mexicana*	SoC	Unlisted
Pale Townsend's Big-Eared Bat	*Corynorhinus townsendii pallescens*	Sensitive (USFS)	Special
Pallid Bat	*Antrozous pallidus*	Unlisted	Sensitive
Silver-Haired Bat	*Lasionycteris noctivagans*	Unlisted	Sensitive
Spotted Bat	*Euderma maculatum*	SoC	Special
Western Red Bat	*Lasiurus blossevillii*	Unlisted	Sensitive
Hidden Forest Uinta Chipmunk	*Neotamias umbrinus nevaden-sis*	SoC	Unlisted

COMMON NAME	SCIENTIFIC NAME	STATUS	
		NATIONAL	STATE
Palmer's Chipmunk	*Neotamias palmeri*	SoC	Unlisted
Fish Spring Pocket Gopher	*Thomomys bottae abstrusus*	SoC	Sensitive
San Antonio Pocket Gopher	*Thomomys bottae curtatus*	SoC	Sensitive
Desert Valley Kangaroo Mouse	*Microdipodops megacephalus albiventer*	SoC	Sensitive
California Myotis	*Myotis californicus*	Unlisted	Sensitive
Cave Myotis	*Myotis velifer*	SoC	Sensitive
Fringed Myotis	*Myotis thysanodes*	SoC	Sensitive
Little Brown Myotis	*Myotis lucifugus*	Unlisted	Sensitive
Long-Eared Myotis	*Myotis evotis*	SoC	Sensitive
Long-Legged Myotis	*Myotis volans*	SoC	Sensitive
Western Small-Footed Myotis	*Myotis ciliolabrum*	SoC	Sensitive
Yuma Myotis	*Myotis yumanensis*	SoC	Sensitive
Western Pipistrelle	*Pipistrellus hesperus*	Unlisted	Sensitive
Pygmy Rabbit	*Brachylagus idahoensis*	SoC	Sensitive
Ash Meadows Montane Vole	*Microtus montanus nevadensis*	SoC	Sensitive
Pahranagat Valley Montane Vole	*Microtus montanus fucosus*	SoC	Sensitive

4.9.1 Desert Tortoise

4.9.1.1 Description of Current Conditions

The desert tortoise (*Gopherus agassizii)* is a native animal that has received a great deal of public attention in southern Nevada because of its status as a threatened species under the federal Endangered Species Act and Nevada Administrative Codes. It is found in undeveloped habitats in the area, though in varying densities. It plays an important role in desert ecosystems by excavating burrows in which it escapes the heat of summer, and in which it hibernates during winter to escape low temperatures. This burrowing habit provides shelters that are used by other animals and assists in the cycling of nutrients, seeds, and biomass in the dry Mojave Desert environment.

Desert tortoise in typical habitat at NAFB.

During a 1991 survey of 5,703 acres, 14 desert tortoises were found in Area II (Sierra Delta Corp., 1991). Any proposed habitat disturbance in that area will require a Section 7 consultation with

USFWS. Through formal consultation with USFWS, NAFB paid $324 per acre, the standard remuneration fee at that time, as minimization measures to develop a new landfill in Area II. A formal consultation was also required for sewer pipeline work on the Base. Desert tortoises can be found in very low densities in Area II of NAFB, from the flight line east to Sunset Mountain. Informal surveys of Area II indicate that the tortoise population increases in density as one moves from the valley to the base of Sunset Mountain. A recent survey found that Area III does not support desert tortoise populations and, because it is isolated and enclosed by artificial barriers, additional surveys will no longer be required by the USFWS on that area (NAFB, 2004). Desert tortoises prefer Mojave Desert valley bottoms and bajadas (alluvial slopes), though they may also be found at slightly higher elevations on rocky hillsides (Germano et al., 1994). They have been observed in low densities in the valleys of Ranges 62 and 63 on the South Range. Maps of NAFB and NTTR depicting the known locations of desert tortoise would be useful for current and future planning.

Tortoise burrow.

The desert tortoise was granted emergency protection under the ESA in 1989, partially as a result of substantial urban and suburban development in the Las Vegas Valley. At that time, numerous agencies, conservation organizations, and private organizations applied for a take permit from the USFWS to allow for continued development. In 1997, the BLM Las Vegas District requested formal Section 7 consultation under the ESA for programmatic activities on specified Federal lands and the incidental take (mortality) of desert tortoises on these lands in southern Nevada. The USFWS issued a programmatic biological opinion incorporating by reference a remuneration fee of $568 for each acre of desert tortoise habitat disturbed (the fee has been indexed to inflation and thereby increases annually). As of February 2, 2004 the amount of the per-acre remuneration fee is $660.00 (Letter from Robert D. Williams, USFWS, Reno, NV, February 2, 2004). The money collected through these plans is used to implement recovery actions on federal lands managed by the BLM, NPS, USAF, USFWS, and Forest Service. Additionally, some of the money has been used to purchase a conservation easement on lands belonging to Boulder City, to fund increased law enforcement on BLM land, to purchase grazing privileges in order to remove the threat to tortoises resulting from grazing on public lands, and for various other conservation programs (RECON, 1994).

Typical desert tortoise habitat at NAFB.

Substantial programs were, and continue to be, focused on the recovery of the desert tortoise. Desert Wildlife Management Areas (DWMAs) have been recommended in the Tortoise Recovery Plan for portions of California, Nevada, Utah, and Arizona. The federal agencies then were directed to incorporate the DWMA/critical habitat into federal use plans. The BLM completed

this in October 1998 when the BLM RMP EIS was signed. It established four Areas of Critical Environmental Concern (ACEC) overlapping with this critical habitat: Piute-Eldorado ACEC, Mormon Mesa ACEC, Coyote Springs ACEC and Gold Butte (Part A) ACEC. The BLM did not propose to establish ACECs on Nellis USAF Base.These management areas will allow for additional conservation, not only for desert tortoises, but for other Mojave Desert plant and animals species.

A BO regarding the terms of use of the lands jointly managed by NTTR and the DNWR was issued by USFWS in June 2003. The BO includes the restriction of military ground use (training and testing) to lands below the 3,600 ft contour line of the Indian Springs Valley and below the 3,940 ft contour line of Three Lakes Valley, and then only on established targets. Recently, on June 30, 2004, the USFWS approved an amendment to this BO which revised Term and Conditions 1.A. and 1.D. Basically, it stated that the Nevada Training Initiative Project (640 acres), Target 62-6, and new proposed projects that may involve surface disturbance should be cleared of desert tortoises in accordance with the last BO. In addition to the project site clearance, on a case-by-case basis, a perimeter around the project areas will also be cleared as determined by the NAFB natural resources manager and the USFWS. The determination to conduct a perimeter clearance will be based on the quality of tortoise habitat in the project area and/or the likelihood of desert tortoises appearing on the project site.

Desert tortoises found and removed from the project site may be fitted with radiotelemetry devices as determined on a case-by-case basis. Telemetered tortoises will be monitored and data collected at least until project construction is completed to determine if tortoises return to the area of capture. Telemetry data will be provided to the USFWS within 30 days of conclusion of telemetry monitoring activities. Other changes in this BO included that if desert tortoises are found in harm's way, they will be captured and released until soil disturbances cease. Unlike the past BO, tortoises are allowed to be moved up to one mile from the point of capture. In addition, the BO requires the site to be monitored until construction or ground disturbance activities are completed. Proposed projects on the extreme South Range will be reviewed for potential impacts to desert tortoises, and consultation with USFWS will be initiated if necessary. A new BA is being prepared for NAFB and the Small Arms Range. This BA will be submitted to the USFWS for their review in early 2006. A new BO will probably be prepared for this BA.

In the table below, projects requiring consultation with the USFWS for desert tortoise are listed.

PROJECT	BIOLOGICAL OPINION	YEAR
Construction of a Construction Debris Landfill on the Nellis Air Force Base	1-5-91-F-38	1991
Operation of Existing Facilities and Development on the Nellis Air Force Base	1-5-91-F-237	1992
Construction of a Sewer Pipeline on Nellis Air Force Base, NV	1-5-93-F-080	1993
Continued Current Weapons Testing/Training on the USAF Weapons Tactics Center Range Complex	1-5-94-F-162	1994
Extend the BO Term for the Weapons Testing/Training on the USAF Weapons Tactics Center Range Complex	1-5-96-F-278R	1996
NTTR Road Construction in Range 61 and 62 (Dogbone Lake Area)	1-5-02-I455	2002

1.6 mile access road in Area II	1-95-1-F-237	2002
Dog Bone Lake Target 62-1 Bypass Road	1-5-03-418	2003
8-inch JP-8 fuel pipeline from Las Vegas Terminal to the ESOS	1-95-1-F-237	2003
Construction of the High Technology Test and Training Complex at NTTR South Range	1-5-02-F-522	2002
Programmatic Biological Opinion for South Range Activities	1-5-02-F-522	2003
Expansion of Military Housing on Nellis Air Force Base, NV. Reno, NV	1-5-04-TA-455 and AF6	2004
Amendment to the Programmatic Biological Opinion for South Range Activities	1-5-02-F-522.AMD1 Allowed for monitoring and removal of desert tortoise vs. fencing	2004
Repair and Upgrade the Quarry Road in Area II	1-95-1-F-237	2004
Construct a Fence along the East Boundary of NAFB in Area II	1-95-1-F-237	2004
Upgrade of the Fuel System at Nellis Air Force Base, NV	1-5-05-1-416	2005

4.9.1.2 Needs Assessment

Need: Current maps showing potential desert tortoise habitat.

Assessment: In general, most of the surveys conducted to delineate desert tortoise habitat were accomplished prior to the year 2000, making most of the data invalid for current mission actions. A few recent studies were conducted in 2004, and the data from these studies will be incorporated into the natural resource database. A comprehensive study was conducted in the South Range of NTTR and showed the presence of some tortoises in that area. However, some of the methodology used in that study is not acceptable by today's standards, and the study was conducted too many years ago to be valid for current projects.

Need: Desert tortoise management plan approved by the USFWS and in close cooperation with NDOW and NTTR range management staff.

Assessment: Because the tortoise is a threatened species, any mission action taking place in tortoise habitat is subject to Section 7 consultation. Following the protocol of Section 7 consultation, a biological assessment must be conducted, the assessment reviewed by the USFWS, and then a biological opinion is released by the USFWS. This process can take as long as 3 to 9 months. Many of the activities involved with mission operations and procedures cannot accommodate long waiting periods for biological opinions to be developed. Negotiations with the USFWS are critical to develop a means to streamline this procedure.

Because of these time limitations, it is critical that the Air Force and USFWS come to agreement upon more effective and efficient ways of determining and delineating tortoise habitat. It is the intent of the INRMP to provide a desert tortoise management plan that can be later formalized and approved by the USFWS to allow for expeditious approval of mission actions in areas that support desert tortoise habitat.

Need: The natural resource database does not contain adequate information on the desert tortoise.

Assessment: Most of the desert tortoise studies conducted prior to 2004 have been entered into the natural resource database. These data, albeit older, can provide some insight as to whether tortoises may or may not inhabit an area. It is critical that these studies be incorporated into the natural resource database until further studies can be conducted to bring the results up to date.

4.9.1.3 Management Goals within the Mission

GOAL 1: To conserve desert tortoise and desert tortoise habitat by avoiding, minimizing or otherwise mitigating impacts by mission actions.

GOAL 2: Survey the South Range of NTTR, NAFB, and any other potential tortoise habitat in a manner to delineate areas that are considered unsuitable and uninhabited by tortoise.

GOAL 3: Maintain an up-to-date natural resource database containing locations of tortoise and tortoise sign found during any surveys conducted on NAFB or NTTR.

GOAL 4: Develop a desert tortoise management plan that will be acceptable for use and approved by the USFWS.

4.9.1.4 Management Guidelines

The military mission always takes precedence over the guidelines recommended in the INRMP. Managers should adhere to the guidelines within the constraints of the mission. However, with respect to desert tortoise and other endangered and threatened species, the AF recognizes the need to comply with ESA and related USFWS issued Biological Opinions (Incidental Take Statement, Reasonable and Prudent Measures, Terms and Conditions, and Conservation Recommendations/Measures).

During the planning and implementation of any mission action, the following steps should be taken to ensure conservation of the desert tortoise:

- **The natural resource database will be reviewed to determine if desert tortoises have ever been observed in the project area.**
- **The mission project manager will consult with 99th CES/CEVN to determine if the site contains habitat potentially supporting desert tortoise.**

As part of the desert tortoise management program:

- **Desert tortoise fences will not be used in NTTR due to the fact that they have been found to be ineffective because of excessive damage caused by mission activities.**
- **In lieu of fencing, qualified desert tortoise monitors will be present on all projects which involve earth disturbing activities. Tortoises found in the project area will be equipped with radio transmitters and transported as far as one mile from the project area to ensure that they remain out of harm's way. The tortoises will be monitored using radio telemetry to ensure that they do not return to the project area until that project is completed.**

Additional specific guidance will be provided in the Desert Tortoise Management Plan to be prepared in December 2006.

4.9.1.5 Projects

Project	Goal	Project No.	Due Date
1. A 100% survey of NAFB should be completed.	1,2	Range, Survey, Update Desert Tortoise	Completed
2. A vegetational survey of the South Range valleys should be conducted to determine the presence of suitable or unsuitable tortoise habitat. This will be accomplished by using color aerial photographs and ground-truthing for observation of plant composition and desert tortoise/tortoise sign. The entire area will be mapped, and the map submitted to the USFWS for their opinion and approval. Close coordination with the USFWS is mandatory. Once this portion is completed, the map will be entered into the natural resource database for use in future mission planning.	1,2	Range, Survey, Update Desert Tortoise	Completed
3. All past tortoise studies should be incorporated into a uniform database and placed in the Natural resource database for use in future planning also. Any new studies will also be incorporated into the Natural resource database. Results from all studies will be used to develop a sensitivity model for mission planning.	3	Range, GIS Database and Aerial Photography	Annual
4. Once the USFWS and the Air Force have come to agreement on suitable and unsuitable desert tortoise habitat, these areas will be delineated and entered into the Natural resource database.	1,2,3	Range, GIS Database and Aerial Photography	Annual
5. Monitor mission activities impacting desert tortoise habitat and relocate tortoises displaced by those actions. Monitor relocated tortoises using radio telemetry. Evaluate future tortoise relocation areas and future habitat restorations. Establish an annual monitor and relocation program.	1	Habitat Management, Desert Tortoise	Annual
6. Investigate disturbed areas to determine the potential for habitat restoration and develop a habitat restoration program.	1	Habitat Management, Desert Tortoise	Annual
7. Implement habitat restoration program as appropriate.	1	Habitat Management, Desert Tortoise	Annual
8. A desert tortoise management plan will be written according to USFWS guidelines.	4	Habitat Management, Desert Tortoise	Jan. 2008

4.9.1.6 References

Literature Cited

Desert Tortoise Recovery Team. 1994. *Desert Tortoise (Mojave Population) Recovery Plan*. Prepared for U.S. Fish and Wildlife Service Regions I, II, and VI. Portland, Oregon.

Germano, D. J., R. B. Bury, T. C. Esque, T. H. Fritts, and P. A. Medica. 1994. In R. B. Bury and D. J. Germano, eds. *Biology of North American Tortoises*. Pages 73-84. U.S. Department of the Interior, National Biological Survey, Fish and Wildlife Research 13. Washington, D.C.

Leslie, M., G. K. Meffe, J. L. Hardesty, and D. L. Adams. 1996. *Conserving Biodiversity on Military Lands: A Handbook for Natural Resource Managers*. The Nature Conservancy, Arlington, Virginia.

NAFB. 2004. Desert Tortoise Survey for Area III at Nellis AFB, Nevada.

RECON. 1994. *Clark County Desert Conservation Plan*. Clark County, Las Vegas, Nevada.

Sierra Delta Corporation. 1991. Transect Data: Biological Assessment for the Mojave Desert Tortoise. Nellis AFB, Nevada.

Additional References

Bechtel Nevada Ecological Services. 1999. Ecological Monitoring and Compliance Program: FY 1999 Report. Las Vegas, Nevada.

Boarman, W.I. Desert Tortoise (*Gopherus agassizii*). 2002. *In: The Sensitive Plant and Animal Species of the Western Mojave Desert*. U.S. Geological Survey, Western Ecological Reseach Center, Sacramento, CA.

Dames & Moore. 1994. Report: Desert Tortoise Survey, South Range Disposal Sites. Nellis Air Force Base, Nevada.

Dames & Moore. 1994. Biological Assessment of the Proposed CBU Target Site at the Nellis Air Force Range. Nellis AFB, Nevada.

Dames & Moore, Inc. 1996. Biological Resources Technical Memorandum. Environmental Assessment: Regional Training Area, Indian Springs Air Force Auxiliary Field. Nellis Air Force Base, Nevada.

Desert Tortoise *(Gopherus agassizii)*. 1988. Chapter Two: Working Draft.

EG&G. 1991. The Distribution and Abundance of Desert Tortoises on the Nevada Test Site. Nellis AFB, Nevada.

EG&G. 1994. The Northern Boundary of the Desert Tortoise Range on the Nevada Test Site. Nellis AFB, Nevada.

Greystone Environmental Consultants, Inc. 2003. Desert Tortoise Mitigation Measure, Draft EIS/EIR.

Nellis Air Force Base. 1994. Final Report of Biological Study in Area II of Nellis Air Force Base.

Nellis Air Force Base. 2002. Draft Environmental Baseline Study: Nellis Terrace Housing Area. Nellis Air Force Base, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Water Wells Annex. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Manch Manor Housing Area. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Dunning Circle Housing Area. Nellis AFB, Nevada.

Nevada Environmental Consultants, Inc. 1998. Biological Assessment: Bureau of Land Management Lands Selected for Withdrawal. Nellis Air Force Base, Nevada.

Nicoletti, Mary Jo. 1991. Mojave Desert Tortoise Survey at Range 63. Nellis AFB, Nevada.

Pratt, Ph.D., William L. 1990. A Desert Tortoise Investigation of the Dogbone Lake Site, Range 62, Nellis Air Force Range. Nellis Air Force Base, Nevada.

Revegetation Innovations. 1992. Fighter Weapons Center Range Complex Biological Assessment for the Desert Tortoise *(Gopherus agassizii)*.

Sierra Delta Corporation. 1991. Transect Data: Biological Assessment for the Mojave Desert Tortoise. Nellis AFB, Nevada.

SWCA, Inc. 1991. Biological Assessment for Mojave Desert Tortoise. Clark County, Nevada.

TRW Environmental Safety Systems, Inc. 1997. The Distribution and Relative Abundance of Desert Tortoises at Yucca Mountain.

U.S. Army Corps of Engineers, Omaha District. 2001. Environmental Assessment for Live Ordnance Departure Area. Nellis Air Force Base, Nevada.

United States Air Force. 2002. Biological Assessment for Desert Tortoise Prepared for Section 7 Formal Consultation and Range-Wide Programmatic Biological Opinion. Nevada Test and Training Range, Air Combat Command. Nellis AFB, Nevada.

United States Air Force Environmental Restoration Program. 2002. Final Report: Desert Tortoise Survey for a Proposed Roadway at Nellis Air Force Base, Nevada.

United States Department of the Air Force. 1994. Final Report of Fall and Winter Surveys for Nine Wildlife Species on Nellis Air Force Base Area II. Nellis Air Force Base, Nevada.

United States Department of the Interior, Fish and Wildlife Service. 1994. Determination of Critical Habitat for the Mojave Population of the Desert Tortoise. Reno, Nevada.

United States Department of the Interior, Fish and Wildlife Service. 1994. Biological Opinion for Continuing Current Weapons Testing/Training on the U.S. Department of the Air Force's Weapons and Tactics Center Range Complex. Las Vegas, Nevada.

United States Department of the Air Force. 2002. Nevada Training Initiative Biological Assessment for Desert Tortoise: Nevada Test and Training Range.

United States Department of the Interior, Fish and Wildlife Service. 1997. Biological Opinion on the Reinitiation of Formal Consultation for Continuing Current Weapons Testing and Training on the U.S. Department of the Air Force's Weapons and Tactics Center Range Complex. Nellis AFB, Nevada.

United States Department of the Interior, Fish and Wildlife Service. 1993. Formal Section 7 Consultation for the Construction of a Sewer Pipeline on Nellis Air Force Base, Nevada.

United States Department of the Interior, Fish and Wildlife Service. 1992. Field Survey Protocol for Any Federal Action that may Occur within the Range of the Desert Tortoise. Ventura Field Office. Found at http://ventura.fws.gov/SurveyProt/de_tortoise.htm.

United States Department of the Interior, Fish and Wildlife Service. 1992. Biological Opinion for the Proposed Operation of Existing Facilities and Development on the Nellis Air Force Base. Nellis AFB, Nevada.

4.9.2 Sensitive Species

Plant and animal species present on NAFB or NTTR will be rigorously conserved when there is no impact to the military mission. Sensitive species do not have legal status, but they have been identified by agencies or conservation organizations as species that are experiencing some level of threat and, therefore, should be managed. In a recent study conducted for the Office of the Under Secretary of Defense, it was concluded that installations that “demonstrated success for species at risk tend to be those that are conducting ecosystem management and that have good working relations with their state resource agencies” (Horne Engineering Services, 2005). It is the intent of this INRMP to accomplish both of these goals in conservation of species of concern and in fostering a good relationship with NDOW and other resource agencies. The sensitive species identified in the INRMP are former federal C2 species or species of concern.

One plant species and five animal species (exclusive of bats) considered sensitive by resource agencies have been observed, or occur, on NAFB property. These are the Las Vegas bearpoppy (*Arctomecon californica*), desert tortoise (Federally listed as Threatened), chuckwalla (*Sauromalus obesus*), western burrowing owl, Banded Gila monster (Heloderma suspectum cinctum), and phainopepla (*Phainopepla nitens*). The bearpoppy populations are small, but their potential occurrence in the location on undeveloped land should be determined by focused surveys. The chuckwalla, a large lizard, has been confirmed in Area II by sightings of the species’ diagnostic scat. Western burrowing owls have been observed on NAFB, and phainopepla are likely at the Desert Wells Annex because of the suitable habitat found on that property. The Phainopepla (Federal: Migratory Bird; State: Protected) is a black bird shaped like a cardinal that is found primarily in mesquite thickets. Several genera of bat species, some of which are sensitive utilize NAFB surface water sources but only the presence of California myotis (*Myotis*

californica) has been confirmed on NAFB. At least 18 species of bats are known within the region.

4.9.2.1 Las Vegas Bearpoppy

4.9.2.1.1 Description of Current Conditions

Las Vegas bearpoppy populations in the Las Vegas Valley have been shown to be genetically unique, and so are of concern to the Nevada Division of Forestry, Clark County, and USFWS. Currently, TNC describes the plant as globally rare and state imperiled, and the State of Nevada lists it as critically endangered. This plant species is known to occur only in Clark County, Nevada and Mohave County, Arizona (Sheldon, 1994). USFWS considers this plant to be among its highest priorities for protection in the state. They hope to avoid federal listing of it as threatened by protecting the existing populations on public lands, which includes populations found on NAFB (Bair, 1997). NAFB has taken steps to conserve the bearpoppy to include early planning of new construction projects to avoid areas known to have bearpoppy plant communities. The species is found exclusively on gypsiferous soils (Sheldon, 1994) and projects proposed on other soil types are not likely to affect the Las Vegas bearpoppy.

The Las Vegas bearpoppy has been identified in four locations on NAFB, which together make up a population of several thousand plants. It was identified in Area II of NAFB in 1993 and in Area III in 1994. The three populations located in Area II in 1993 were re-surveyed in 1996. A large population of at least 1,000 individuals is located near the extreme southeastern boundary of Area II (accessed from Lake Mead Boulevard). This bearpoppy plant population lies near an area that has typically been used for small arms practice and dumping, and therefore, may be subjected to disturbance. A second Las Vegas bearpoppy population of approximately 200 individuals occurs in an area known as Trollville, northeast of the above area and just south of some desert tortoise enclosure fences (Knight, 1997). A third, small population is located in the north-central portion of Area II, near a series of active sand dunes. This population is also exposed to potential habitat disturbance, primarily from unauthorized recreational motorcycle riding. The population occurring in Area III is located behind the NAFB hospital and housing. The Area III Las Vegas bearpoppy population is the largest on NAFB. A recent survey of the area indicated that the bearpoppy populations were in excess of 1000 plants. In addition, a population of Las Vegas buckwheat (*Eriogonum corymbo-*

Las Vegas Buckwheat

sum var. *nilesii*), proposed as a state Critically Endangered Species was observed and documented.

During the literature and regulatory review preceding the 1993 survey, TNC identified bearpoppy, then a candidate species. The survey identified an estimated 11,000 bearpoppy plants, causing TNC to announce its willingness to support a de-listing petition which would remove the plant from consideration as a federally threatened species (TNC, 1994; Vogel, 1997; Lillie and Ripley, 1998). As of April 1996, USFWS does not consider the bearpoppy to be a candidate species for protection, though TNC describes it as globally rare and as a state imperiled plant. Efforts will continue to be taken to ensure that military activities or development avoid known populations of this plant, whenever possible and practicable.

Las Vegas buckwheat grows in dry, stony grasslands and other sparse habitats supported by gypsiferous soils often forming low mounds or outcrops in washes and drainages, or in areas of generally low relief. The plant is often growing in close association with Las Vegas Bearpoppy and other desert basin plants such as burro-weed and creosote bush. Unlike the Las Vegas Bearpoppy, the Las Vegas buckwheat is a perennial shrub ranging from 1 to 4 ft. in height. The plant has pale yellow flowers and sparse silvery tufts of cobwebby hair on flowering branches and upper leaf surfaces. Though this plant is not officially afforded protection under state and federal regulation, it is on several watch lists for its rarity and declining population.

4.9.2.1.2 Needs Assessment

Need: Locations of Las Vegas bearpoppy populations and areas of potential habitat (gypsiferous soils) should be mapped and entered into the natural resource database.

Assessment: Recently, a comprehensive survey of Area III for Las Vegas bearpoppy, and Las Vegas buckwheat was conducted (NAFB, 2004). Locations of plants were designated using GPS coordinates. In addition, large populations of bearpoppy were delineated. Information concerning all of the plants was incorporated in a GIS database that will later become part of the natural resource database. However, the other three known populations of bearpoppy found on NAFB have not been identified in recent years. These populations need to be located using GPS coordinates and their locations entered into the INRMP GPS database. Additionally, locations of suitable habitat for bearpoppy have not been delineated on NAFB or NTTR. Suspect areas would be gypsiferous soils located in the South Range of NTTR and on NAFB. Information concerning soils is extremely important because it will allow designation of areas as potential bearpoppy habitat and activities impacting those areas can be surveyed to determine if any of the plants are present.

4.9.2.1.3 Management Goals within the Mission

GOAL 1: To identify and delineate known and potential Las Vegas bearpoppy and Las Vegas buckwheat populations and habitat based on gypsiferous soils in NAFB and NTTR.

GOAL 2: To minimize impacts to established populations of Las Vegas bearpoppy and Las Vegas buckwheat.

4.9.2.1.4 Management Guidelines

The military mission always takes precedence over the guidelines recommended in the INRMP. Managers should adhere to the guidelines within the constraints of the mission.

During the planning and implementation phase of any mission activity, the following steps should be taken:

- **The planned site for the action should be surveyed to determine the presence of known populations of Las Vegas bearpoppy and Las Vegas buckwheat or potential populations based on gypsiferous soils. This information should be entered into the natural resource database.**
- **All activities impacting Las Vegas bearpoppy populations and Las Vegas buckwheat populations should involve consultation with the USFWS to ensure that they are aware of activities taking place. Additionally, the Nevada Division of Forestry should be consulted.**

For general management of Las Vegas bearpoppy and Las Vegas buckwheat at NAFB and NTTR, the following should be considered:

- **The USFWS and the Nevada Division of Forestry should be contacted if impacts to established populations of Las Vegas bearpoppy and Las Vegas buckwheat are anticipated.**
- **If possible, known populations of Las Vegas bearpoppy and Las Vegas buckwheat should be conserved.**
- **During any project where gypsiferous soils are encountered, those areas should be surveyed to determine potential for Las Vegas bearpoppy and Las Vegas buckwheat. Information concerning location of Las Vegas bearpoppy and Las Vegas buckwheat and gypsiferous soils should be entered into the natural resource database.**

4.9.2.1.5 Projects

Project	Goal	Project No.	Due Date
1. Previously identified Las Vegas bearpoppy, Las Vegas buckwheat, and other rare plant populations should be surveyed and monitored annually to determine if plants are still present. Information should be entered into natural resource database. The location of both live and dead or dormant plants should be included.	1	Survey, Monitor Unique Habitats and Rare Plants	Annual
2. During soil surveys, any gypsiferous soils should be identified as potential habitat for the Las Vegas bearpoppy and Las Vegas buckwheat. Those areas should then be surveyed for the presence of either of these species and if plants are identified, their locations entered into the natural resource database.	1	Survey, Monitor Unique Habitats and Rare Plants	Annual

Project	Goal	Project No.	Due Date
3. Identified Las Vegas bearpoppy and Las Vegas buckwheat populations should either be carefully marked for easy identification to minimize impacts by any action on NAFB or NTTR. NAFB personnel should be educated as to the identification of Las Vegas bearpoppy and Las Vegas buckwheat if projects or mission actions are to occur in the areas supporting established populations.	2	Survey, Monitor Unique Habitats and Rare Plants	Annual

4.9.2.1.6 References

Literature Cited

Bair, J. 1997. U.S. Fish and Wildlife Service, Reno, Nevada. Personal communication.

Knight, T. A. 1997. Botanist, The Nature Conservancy of Nevada, Las Vegas, Nevada. Personal communication.

Lillie, T. H., and J. D. Ripley. 1998. A strategy for implementing ecosystem management in the United States Air Force. *Natural Areas Journal* 18(1): 73-80.

Horne Engineering Services. 2005. Best Practices for Integrated Natural Resources Management Plan (INRMP) Implementation. A study for the Under Secretary of Defense, Installation and Environment.

NAFB. 2004. Las Vegas Bearpoppy and Las Vegas Buckwheat Surveys on Area III of Nellis AFB, Nevada.

Sheldon, S. K. 1994. Life history, biology, and soil characteristics of two species of *Arctomecon (Papaveraceae).* Unpublished Master's thesis, University of Nevada, Las Vegas.

The Nature Conservancy (TNC). 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*. Las Vegas, Nevada.

Vogel, G. 1997. The Pentagon steps up the battle to save biodiversity. *Science* 275:20.

Additional References

Mistretta, Orlando, Rashmi Plant, Timothy S. Ross, J. Mark Porter, and James D. Morefield. 1996. Current Knowledge and Conservation Status of *Arctomecon californica* Torrey & Fremont (Papaveraceae), the California Bearpoppy. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Draft Environmental Baseline Study: Nellis Terrace Housing Area. Nellis Air Force Base, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Water Wells Annex. Nellis AFB,

Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Manch Manor Housing Area. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Dunning Circle Housing Area. Nellis AFB, Nevada.

Nevada Environmental Consultants, Inc. 1998. Biological Assessment: Bureau of Land Management Lands Selected for Withdrawal. Nellis Air Force Base, Nevada

PBS&J. 2000. Quarterly Monitoring Report. Las Vegas Bearpoppy Mitigation for Vandenburg Detention Basin and Land Lucky Properties.

Powell, Elizabeth. 1999. Report on Las Vegas Bear Poppy (*Arctomecon californica*) Monitoring. National Park Service. Lake Mead National Recreation Area.

SWCA, Inc. 1991. Biological Assessment for Mojave Desert Tortoise. Clark County, Nevada.

United States Air Force Environmental Restoration Program. 2002. Las Vegas Bearpaw Poppy and Las Vegas Buckwheat Surveys on a Proposed Residence Expansion Parcel. Nellis Air Force Base, Nevada.

U.S. Army Corps of Engineers, Omaha District. 2001. Environmental Assessment for Live Ordnance Departure Area. Nellis Air Force Base, Nevada.

United States Department of Defense Legacy Resource Management Program. 1997. An Inventory of 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, Part A: The Inventory.

United States Department of Defense Legacy Resource Management Program. 1997. An Inventory of 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, Part C: The Vegetation Analysis.

4.9.2.2 Rare Plants

4.9.2.2.1 Description of Current Conditions

TNC conducted surveys of rare plant species on NTTR in 1992 and 1994. In the course of these surveys, they did not identify any species that are currently federally listed as threatened or endangered. However, 55 plant species were identified as occurring or potentially occurring on NTTR based on the NNHP ranking system. Of the 55, 15 were located during the study (NAFB, 1997). These 15 species of concern are listed in Table 4-2. One federal candidate for listing has been found on the Range, *Astragalus oophorus* var. *clokeyanus* (Bair, 1997). Two new plant species of *Phacelia (Hydrophyllacae)--[Phacelia filiae and Phacelia petrosa]*—are species of concern and were recently identified on NTTR by TNC in cooperation with the USFWS Western Ecological Services, and Brigham Young University.

Growth form of *Astragalus oophorus* var. *clokeyanus* at site 7 in Lee Canyon, Spring Mountains. All photographs by Frank Smith courtesy of Nevada Natural Heritage Program Status Report March 2002.

TABLE 4-6
Plant Species of Concern Located on NTTR

SPECIES OF CONCERN	FEDERAL STATUS		STATE STATUS	BLM STATUS	NNHP RANK-ING
	Pre-1996	Post-1996			
Arctomecon merriamii	C2	SOC	None	Special Status Species	G3S3
Astragalus ackermanii	C2	SOC	None	None	G2S2
Astragalus amphioxys var. *musimonum*	C2	SOC	None	Special Status Species	G5T2S2
Astragalus beatleyae	C1	SOC	None	Special Status Species	G2S2
Astragalus funereus	C2	SOC	None	Special Status Species	G2S2
Astragalus gilmanii	C2	SOC	None	Special Status Species	G3S1
Astragalus mohavensis var. *hemigyrus*	C2	SOC	CE	Special Status Species	TST3G3S2S3
Astragalus oophorus var. *clokeyanus*	C1	None	None	Special Status Species	G4T1S1
Chrysothamnus eremobius	C2	SOC	None	Special Status Species	G1S1
Cymopterus ripleyi var. *saniculoides*	C2	SOC	None	Special Status Species	G2T1S1
Erigeron ovinus	C2	SOC	None	Special Status Species	G2S2
Penstemon pahutensis	C2	SOC	None	Special Status Species	G3S3
Phacelia beatleyae	C2	SOC	None	Special Status Species	G3S3
Phacelia filiae					
Phacelia parishii	C2	SOC	None	Special Status Species	G2S1G2G3S2S3
Porophyllum pygmaeum	C2	SOC	None	Special Status Species	G2S2

4.9.2.2.2 Needs Assessment

Need: Rare plants on NAFB and NTTR should continue to be surveyed, mapped and monitored.

Assessment: TNC conducted an excellent survey of rare plants that was completed in 1997. This survey listed several species of rare plants identified on NTTR and showed their location on USGS topographic maps. Since that time, these populations have not been surveyed or monitored. In addition, information concerning those populations has not been entered into the natural resource database. This information is critical for planning mission activities in an effort to avoid or minimize impacts to these rare plant populations. Because it is the intention of the INRMP to conserve and manage the plant communities within ecosystems, surveying and monitoring rare plant populations is important. These studies could be conducted in conjunction with soils, geology, and vegetation mapping studies.

4.9.2.2.3 Management Goals within the Mission

GOAL 1: Survey and monitor existing populations of rare plants on NTTR and NAFB.

GOAL 2: Conserve and minimize impacts to known populations of rare plants on NTTR and identify any new populations that may become established. Once geology, soils, and vegetation have been mapped for NTTR and NAFB, potential habitat for rare plants and rare animals can be identified based on those characteristics.

4.9.2.2.4 Management Guidelines

The military mission always takes precedence over the guidelines recommended in the INRMP. Managers should adhere to the guidelines within the constraints of the mission.

During the planning or implementation of any proposed action, the natural resource manager should be consulted concerning the following:

- **Location of any rare plant populations that could be potentially impacted by the mission.**
- **If rare plant populations are identified and could be impacted by the mission action, the action should be modified to avoid or minimize impacts to the rare plants where practical.**
- **If impacts to rare populations cannot be avoided, methods of mitigation should be developed, which may include transplanting the plant population to another suitable habitat.**
- **If plants are transplanted to a new location, the location should be selected such that it can be avoided by future impacts if practical.**

For management of rare plants, the following steps are suggested:

- **99th CES should keep and be kept current with any new species of rare plants that may be found on NTTR based on ecological parameters such as soils, vegetation, and geology/hydrology. GIS modeling can be used to determine any areas on NTTR that may potentially support new rare plant populations, and those areas should be surveyed to determine if those populations are present.**
- **Any rare plants identified on the NTTR or NAFB should be entered into the natural resource database according to their GPS coordinates and any other information that is deemed necessary by the natural resource manager. If at all possible, mission activities should avoid or at least minimize impacts to rare plant populations where practical.**

4.9.2.2.5 Projects

Project	Goal	Project No.	Due Date
1. Information collected by the TNC 1997 Rare Plant Study should be incorporated into the natural resource database. This information can then be used in developing a sensitivity model for planning purposes of NTTR and NAFB.	1	Range, GIS Database and Aerial Photography	Con33TjETf

Bombing and Gunnery Range, Clark, Lincoln, and Nye Counties, Nevada. Submitted to The Nature Conservancy. Las Vegas, Nevada.

Pritchett et al. 2001. 2000. Monitoring of *Phacelia parishii* at Nellis Air Force Bombing and Gunnery Ranges. Nellis Air Force Base, Nevada.

Pritchett, Daniel and Frank J. Smith. 1999. Initiation of Long Term Monitoring of *Phalcelia parishii* at Nellis Air Force Bombing and Gunnery Ranges: Clark, Lincoln and Nye Counties, Nevada.

Nellis Air Force Base. 2002. Draft Environmental Baseline Study: Nellis Terrace Housing Area. Nellis Air Force Base, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Dunning Circle Housing Area. Nellis AFB, Nevada.

Nevada Environmental Consultants, Inc. 1998. Biological Assessment: Bureau of Land Management Lands Selected for Withdrawal. Nellis Air Force Base, Nevada.

Pritchett, Daniel and Frank J. Smith. 2000. 1999 Monitoring of Phacelia parishii at Nellis Air Force Bombing and Gunnery Range: Clark, Lincoln and Nye Counties, Nevada. *For* The Nature Conservancy, Las Vegas, Nevada.

Smith, Frank J. Western Ecological Services, Inc. 1999. Overlooked Phacelia from Southern Nevada. Las Vegas, Nevada.

United States Department of Defense Legacy Resource Management Program. 1997. An Inventory of 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, Part A: The Inventory.

United States Department of Defense Legacy Resource Management Program. 1997. An Inventory of 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, Part C: The Vegetation Analysis.

4.9.2.3 Sage Grouse

4.9.2.3.1 Description of Current Conditions

In recent years, the sage grouse, a popular game species, has declined in numbers and distribution in Nevada. Because of the downward trend in numbers, concerned citizens have advocated a Range-wide listing under the ESA. At the time of this INRMP preparation, data was being collected by the USFWS for making a determination as to the status of the sage grouse on the federal endangered and threatened species listing. On January 7, 2004, the USFWS completed its status review of the sage grouse throughout its range and determined that the species does not warrant protection under the Endangered Species Act at this time. However, the USFWS also stated, "...the status review clearly illustrates the need for continued efforts to conserve sage-grouse and sagebrush habitat on a long-term basis." It is the intent of the INRMP to support conservation of this species on NTTR.

Sage grouse is the largest of the North American grouse, with males ranging from 27 to 34 inches in length and weighing 5 to 7 pounds. The male has two air sacs called esophageal pouches which are covered with short, stiff, scale-like white feathers. These are located on each side of the lower neck and upper breast. The pouches are distended, displaying two yellow pear-shaped patches of bare skin during strutting.

Male Sage Grouse
Courtesy USFWS
http://mountain-prairie.fws.gov/species/birds/sagegrouse/

Sage grouse engage in a lek mating system. Leks are essentially strutting grounds where males perform their strutting display prior to breeding. Because "strutting ground" is a more commonly used term in Nevada, it will be used in the INRMP to replace the term "lek." Most of the mating in a flock of sage grouse is accomplished by only a few males on the strutting ground. Males do not participate in incubation or parental care, nor do they exhibit territorial behavior away from the strutting ground. In fact, male flocks are commonly encountered during periods of the year when breeding is not occurring. In most cases, strutting grounds are used year after year and are excellent areas for observing the bird.

Nesting habitat for the sage grouse is characterized primarily by big sagebrush communities having 15% to 38% canopy cover with a grass and forb understory. Potential sage grouse habitat has been observed in the North Range in the area of the Kawich Range. Live sage grouse have been observed by NDOW in the area at the boundary between NTTR and BLM public lands on the Kawich Range, and the grouse may be inhabiting the Belted Range.

4.9.2.3.2 Needs Assessment

Need: Studies should be conducted to determine if the sage grouse is present on NTTR.

Assessment: At the current time, no studies have been conducted to identify the presence of potential habitat for sage grouse. In addition, no live bird studies have been conducted. Although the bird is not listed as endangered or threatened, it is important that NTTR determine if habitat is present on the North Range and if any sage grouse are present in that habitat. Populations could decline and the species could be listed in the future if present populations are not conserved. Conservation of this species now could prevent listing of the bird in the future. If the bird becomes listed, much of the upfront work that may be required for biological assessments and biological opinions will have been completed and will expedite any formal consultation with the USFWS.

4.9.2.3.3 Management Goals within the Mission

GOAL 1: Conserve populations of sage grouse at NTTR by avoiding and/or minimizing impacts to bird populations by mission actions.

GOAL 2: Survey, locate, and map potential sage grouse habitat and incorporate the collected data into the natural resource database.

4.9.2.3.4 Management Guidelines

The military mission always takes precedence over the guidelines recommended in the INRMP. Managers should adhere to the guidelines within the constraints of the mission.

During the implementation or planning of any mission action, the following steps should be taken to ensure conservation of sage grouse:

- **The natural resource database should be reviewed to determine if potential habitat or sage grouse is present in the project area.**
- **If the site is known to contain substantial stands of big sagebrush, it should be surveyed for the presence of sage grouse.**
- **If sage grouse or sage grouse habitat is found to be on the site, an effort should be made to minimize or avoid impacts where practical.**
- **If the mission action cannot be modified to avoid impacts to sage grouse, formal consultation with the USFWS may be required if the species were to become listed as endangered or threatened. NDOW should also be consulted to determine if any further actions should be taken for conservation of the sage grouse population.**

For management of the sage grouse:

- **Information concerning the location of potential sage grouse habitat and live bird sightings should be incorporated into the natural resource database. Especially critical would be observation and location of any strutting grounds, which are extremely sensitive to impacts.**
- **Initial helicopter surveys should be conducted in areas containing potential habitat to determine if any live birds are present.**
- **Once sage grouse habitat has been observed, strutting ground surveys and helicoptor surveys should be conducted on an annual basis to monitor the activity and health of the bird populations in the area. NDOW currently has a protocol checklist, which can be used for surveys.**
- **99th CES/CEVN should coordinate all survey activities for the sage grouse with NDOW and the USFWS.**

4.9.2.3.5 Projects

Project	Goal	Project No.	Due Date
1. A helicopter survey of the North Range, especially the Kawich Mountains, should be conducted annually to determine if sage grouse and/or big sage plant communities are present in the area. Any information collected during the survey should be incorporated into the natural resource database.	2	Candidate Species Survey—Monitor Distribution	Annual

Project	Goal	Project No.	Due Date
2. If sage grouse populations are identified during the aforementioned survey, strutting ground surveys and continued monitoring of those populations should be conducted annually to monitor the distribution, depredation, reproduction, population status and trends, and mortality of sage grouse populations on NTTR.	1,2	Candidate Species Survey—Monitor Distribution	Annual

4.9.2.4 Pygmy Rabbit

4.9.2.4.1 Description of Current Conditions

In March 2003, the pygmy rabbit was federally listed as an endangered species in Oregon. These rabbits are found in the Great Basin, which comprises approximately two-thirds of the land area of NTTR. This animal is the only rabbit in the U.S. that digs its own burrows and typically prefers deep loamy soils for burrowing. Additionally, this is the smallest rabbit known in the world and is dependent upon sagebrush for winter food.

Unlike most of the cottontail rabbits, pygmy rabbits have an entirely gray-brown tail lacking a white underside. The species prefers shrub grasslands found on alluvial fans, floodplains, plateaus, high mountain valleys, and mountain slopes where suitable sagebrush cover and soils for burrowing are available. Although the species may be found on a relatively sparse cover of sagebrush and shallow soils, it prefers patches of dense sagebrush and deeper soils. Big sagebrush is the dominant shrub at all sites where the pygmy rabbit has been observed. In most cases, big sagebrush cover averages 21-23%, with bare ground averaging 33% and herbaceous broadleaf forbs averaging 5-6%. The average height of sagebrush in occupied sites was 16 inches.

Pygmy rabbits dig burrows that extend to a depth of 3 ft and often form chambers as part of the burrow system. Big sagebrush is the primary food source for the pygmy rabbit, but grasses and forbs are also eaten, especially in mid-to-late summer. The pygmy rabbit can be active at any time of day but is usually active early in the morning and late in the afternoon. No special management methods have been developed or implemented specifically for pygmy rabbits. The species appears to be dependent upon big sage and does not do well in its absence. The actual cause of the decline in the population is unknown but may be due to burning and heavy grazing that have resulted in removal of sagebrush.

Pygmy Rabbit
Courtesy NDOW
http://ndow.org/wild/animals/facts/rabbit_pygmy.shtm

Although the pygmy rabbit has not been identified on NTTR, several populations of big sagebrush are known to exist on the Kawich Range of the North Range. In fact, a pygmy rabbit scats and sign were observed at a spring in the Kawich Range during a recent helicopter survey. Pygmy rabbit habitat overlaps with sage grouse habitat, and the two could be easily surveyed together.

4.9.2.4.2 Needs Assessment

Need: Surveys to identify and determine the distribution of pygmy rabbits on NTTR should be conducted because it is a species at risk.

Assessment: At the present time, the status of the pygmy rabbit on NTTR is unknown. As mentioned above, substantial stands of big sagebrush are located in the North Range area and should be surveyed to determine the presence of pygmy rabbits. Because these rabbits are now a listed endangered species, it is critical to determine their locations in an effort to avoid Section 7 consultation with the USFWS if military mission activities impact this species.

4.9.2.4.3 Management Goals within the Mission

GOAL 1: Survey the North Range for habitat conducive to the pygmy rabbit. Additionally, areas containing big sagebrush should be surveyed for evidence of the rabbit, including live animals, scat, and burrows.

GOAL 2: Develop a pygmy rabbit management plan that will meet the requirements of USFWS for conservation of the species in NTTR.

4.9.2.4.4 Management Guidelines

The military mission always takes precedence over the guidelines recommended in the INRMP. Managers should adhere to the guidelines within the constraints of the mission.

During the implementation or planning of any mission action, the following steps should be taken with respect to the pygmy rabbit:

- **The site should be surveyed to determine the presence of big sagebrush. If vegetation surveys have been previously conducted, those should be reviewed to determine if big sagebrush is present.**
- **99th CES/CEVN should be consulted to conduct live animal and burrow surveys on the area potentially impacted by the mission.**
- **If positive evidence of pygmy rabbits is found on the site, consultation with the USFWS should be initiated.**

4.9.2.4.5 Projects

Project	Goal	Project No.	Due Date
1. During sage grouse and vegetation surveys, areas supporting big sagebrush should also be surveyed for pygmy rabbit. Pygmy rabbit habitat and location of any pygmy rabbits or rabbit burrows should be located using GPS equipment and data incorporated into the GIS database. Using this information, areas potentially supporting the pygmy rabbit can be identified and mapped for planning purposes.	1	Candidate Species Survey—Monitor Distribution	June 2007

Project	Goal	Project No.	Due Date
2. Develop a pygmy rabbit management plan for NTTR.	2	Candidate Species Survey—Monitor Distribution	June 2008

4.9.2.4.6 References

Literature Cited

Montana Animal Field Guide. 2004. http://fwp.state.mt.us/fieldguide.

Washington Department of Fish and Wildlife. 2004. http://wdfw.wa.gov.

4.9.2.5 Western Burrowing Owl

4.9.2.5.1 Description of Current Conditions

The western burrowing owl (*Athene cunicularia*) is a species native to southern Nevada that adapts well to urban environments. Western burrowing owls are a former federal species of concern and are a protected species in Nevada (NAC 503.050). Western burrowing owls in southern Nevada may be summer residents, winter visitors, or year-round residents. Some are at least summer residents as demonstrated by July 1996 observations. Western burrowing owls were observed during daytime work on the sanitary landfill at the south end of the Base, where one adult was observed raising four young. They have also been observed along flood control channels on the southeast side of NAFB, the Live Ordnance Departure Area in Area II, and in Area III on the northwest side of the base.

Burrowing Owl observed in Area III

The western burrowing owl averages 24 cm in length and is distinguished from other small owls by bold spots and bars and relatively long, unfeathered legs. The western burrowing owl is an arid land resident that is relatively tolerant of urban development and is found in many areas of Clark County. They adapt their hunting to take advantage of the most readily available food source. If lizard populations are relatively high, the western burrowing owls will hunt by day. Increasing human presence west of the 100th meridian in North America has encouraged western burrowing owls to use human-caused disturbance areas such as golf courses, airports, and road cuts for habitat(Herron et al., 1985; National Geographic Society, 1987).

The USFWS recommends that burrows or roosting sites not be disturbed, when possible, and that artificial burrows be constructed nearby when development activities destroy active burrows or roosting sites (e.g. Trulio, 1995). The Las Vegas USFWS Ecological Services office is currently developing specific mitigation measures in conjunction with Clark County.

Many individual western burrowing owls have been sighted in and around NAFB. They favor the flat, previously disturbed areas that are found around the southern boundary of NAFB, including the edges of concrete flood control channels, for the excavation of their burrows. Western burrowing owls have been sighted along the south perimeter of Area I during construction activities. In 1995, a western burrowing owl was observed on a Clark County Regional Flood Control District (CCRFCD) construction project adjacent to the Area I golf course. The burrow used by that owl was collapsed and two artificial burrows were established to the east of the site as mitigation. In 1996, maintenance of a CCRFCD channel within Area I disturbed two western burrowing owls, and four burrows were established in the southwest portion of Area I to comply with USFWS recommended mitigation. Also during 1996, western burrowing owls were discovered during landfill construction in the far southern extreme of Area I, south of the golf course. Because at least one adult was attending four young birds, construction activities were diverted away from the area until all the young were fledged. Further surveys of the area, including investigation of the burrows with fiber optics, revealed that the burrowing owls had left the site, and construction activities continued. Recently, burrowing owl populations have been observed at the golf course, the Live Ordnance Departure Area in Area II, and Area III at NAFB (NAFB, 2004). With continued development of NAFB and the surrounding metropolitan areas, further effects on these birds are likely. Successful use of artificial burrows by western burrowing owls has been documented (Trulio, 1995) and is being considered as a management option by the USFWS in Las Vegas (Collins, 1996).

During biological surveys of the Indian Springs Air Force Auxiliary Field, a western burrowing owl, and other sign thereof, was observed along the extreme northern boundary. No development is anticipated along this boundary, and so the owl or owls are unlikely to be affected by human activities. Any future development proposals at CREECH AFB will take into account the potential for the occurrence of this bird.

4.9.2.5.2 Needs Assessment

Need: Surveys to determine the distribution of burrowing owls at NTTR and NAFB should be conducted.

Assessment: During the preparation of this INRMP, no studies specifically addressing burrowing owls were found for NAFB or NTTR. However, several reports mentioned occurrence of burrowing owls on NAFB around the golf course and landfill and in the South Range of NTTR.

Because the burrowing owl is a state-listed species, studies should be conducted to document the location of burrowing owls on NAFB and to confirm any sightings that have been made in the past. Most importantly, any areas that are to be used for mission actions should be surveyed prior to the action to determine if the burrowing owl if present.

4.9.2.5.3 Management Goals within the Mission

GOAL 1: Conserve burrowing owl populations by minimizing or avoiding impacts due to mission activities where possible. If impacts are unavoidable, proper mitigation procedures should be used to move burrowing owls from the area.

GOAL 2: Monitor areas where burrowing owls have been observed to ensure that populations are conserved and remain in good health.

4.9.2.5.4 Management Guidelines

The military mission always takes precedence over the guidelines recommended in the INRMP. Managers should adhere to the guidelines within the constraints of the mission.

During the planning and implementation of any mission action, the following steps should be taken concerning burrowing owls:

- **The natural resource database should be reviewed to determine if any burrowing owls have been observed in the project area.**
- **The area should be surveyed for live burrowing owls or indirect evidence of burrowing owls including scat and burrows.**
- **If burrowing owls are discovered in the area of the mission action, the execution, design, or location of the mission should be modified to avoid or minimize impacts to the owls, if practical.**
- **If impacts are unavoidable, proper mitigation procedures should be used to ensure that the burrowing owl is not harmed and is removed from the area.**

For general management of the burrowing owl, the following steps should be taken:

- **99th CES/CEVN should ensure that any observations of burrowing owls be documented in the natural resource database. Information on the owls should include, but should not be limited to, location (GPS coordinates), type of observation (live bird or sign), type of sign, and status of the nest, if present.**
- **If the burrowing owls are observed on the site and impacts cannot be avoided, burrows, holes, crevices, and other cavities on the construction site should be collapsed before the breeding season begins in March and after nesting ends in August to discourage owls from breeding on the construction site.**

4.9.2.5.5 Projects

Project	Goal	Project No.	Due Date
1. During all other surveys and projects at NTTR and NAFB, any burrowing owl habitat or birds should be identified, located, and the data incorporated into the Natural resource database. Information from past studies should also be incorporated into the database.	1	Range, GIS Database and Aerial Photography	Jan. 2008
2. Annual owl surveys should be conducted in areas supporting habitat conducive to burrowing owls to locate owl populations on NTTR. Known populations should be monitored on an annual basis.	1,2	Candidate Species Survey—Monitor Distribution	Annual

4.9.2.5.6 References

Literature Cited

Collins, M. 1996. Wildlife Biologist, U.S. Fish and Wildlife Service. Personal communication.

Herron, G. B., C. A. Mortimore, and M. S. Rawlings. 1985. *Nevada Raptors; Their Biology and Management*. Biological Bulletin No. 8. Nevada Department of Wildlife, Reno.

NAFB. 2004. Biological Assessment for the Desert Tortoise for Nellis AFB, NV.

National Geographic Society. 1987. *Field Guide to the Birds of North America*, Second Edition. National Geographic Society, Washington, D.C.

Trulio, L.A. 1995. Burrowing owls thrive in artificial habitat (California). *Restoration and Management Notes*, 13(2): 238-239.

Additional References

Bechtel Nevada Ecological Services. 1999. Ecological Monitoring and Compliance Program: FY 1999 Report. Las Vegas, Nevada.

Dames and Moore. 1997. Nellis Air Force Range Wetlands Survey Report.

Dames & Moore, Inc. 1996. Biological Resources Technical Memorandum. Environmental Assessment: Regional Training Area, Indian Springs Air Force Auxiliary Field. Nellis Air Force Base, Nevada.

Nellis Air Force Base. 1994. Final Report of Biological Study in Area II of Nellis Air Force Base.

Nellis Air Force Base. 2002. Draft Environmental Baseline Study: Nellis Terrace Housing Area. Nellis Air Force Base, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Manch Manor Housing Area. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Dunning Circle Housing Area. Nellis AFB, Nevada.

Nevada Environmental Consultants, Inc. 1998. Biological Assessment: Bureau of Land Management Lands Selected for Withdrawal. Nellis Air Force Base, Nevada.

United States Department of the Air Force. 1994. Final Report of Fall and Winter Surveys for Nine Wildlife Species on Nellis Air Force Base Area II. Nellis Air Force Base, Nevada.

4.9.2.6 Chuckwalla

4.9.2.6.1 Description of Current Conditions

The chuckwalla is a relatively large lizard that was formerly considered federal candidate for listing as threatened or endangered. The chuckwalla has been recorded on NAFB by the identification of diagnostic scat in the far eastern portion of Area II, where rocky hillsides are present. Chuckwallas emerge on warm mornings to bask until their body temperature reaches approximately 100°F, at which time they begin to forage on plants and fruits. Their coloring consistently includes a black head and forelegs, but the body colorings can be extremely variable among individuals, ranging from black to red to yellow. Females and juveniles may be banded. Females are thought to lay 5-10 eggs every other year. Chuckwallas are shy and extremely hard to catch due to their habit of wedging themselves in a rock crack and inflating their body with air, rendering them difficult to move.

Chuckwalla
USFWS Photo by Jim Rorabaugh

A survey of the Indian Springs and Three Lakes Valley in the South Range of NTTR was conducted in 1994 to determine if chuckwalla inhabited the area (Dames and Moore, 1994). The study included Ranges 62, 63, 64, and 65. Of 54 sites surveyed, 52 contained chuckwalla sign usually in the form of scat. Additionally, two live chuckwallas were observed. The chuckwalla were found to prefer the rocky areas along the base of the mountains at elevations of 3000 to 4500 ft. Additional current surveys need to be conducted to further delineate the habitat of this species on the South Range and NAFB.

4.9.2.6.2 Needs Assessment

Need: Very little information is available on the distribution of chuckwalla on NAFB or NTTR.

Assessment: As previously mentioned, chuckwalla scat was identified in the far eastern portion of Area II, but no live animals were observed. Air Force personnel should be aware of the potential presence of this reptile and provide information to the natural resource manager if the reptile is observed.

4.9.2.6.3 Management Goals within the Mission

GOAL 1: To avoid or minimize impacts to the chuckwalla or its habitat.

GOAL 2: To incorporate any location or observation data collected on the chuckwalla and incorporate the data into the Natural resource database.

4.9.2.6.4 Management Guidelines

The military mission always takes precedence over the guidelines recommended in the INRMP. Managers should adhere to the guidelines within the constraints of the mission.

- **Prior to planning or implementation of any Air Force action, the natural resource database should be reviewed to determine if chuckwallas have been observed in the vicinity of the project.**
- **During the preparation of the environmental assessment for any project area, the area should be surveyed to determine if chuckwallas or their habitat are present.**
- **If chuckwallas are present on the site, either historically or if they have been directly observed, an effort should be made to avoid or minimize impacts to the lizard. If impacts are unavoidable, as a courtesy, NDOW should be consulted. It may be necessary to move the chuckwalla from the project site to a suitable habitat.**
- **Prior to initiation of construction in an area that may support chuckwallas, construction personnel should be briefed on identification of the chuckwalla. Construction personnel should be advised to consult with the natural resource manager if chuckwallas are observed on the site.**

4.9.2.6.5 Projects

Project	Goal	Project No.	Due Date
1. Collect any information from on-base and off-base sources that may assist in locating areas where the chuckwalla has been observed on or near NTTR or NAFB.	2	Candidate Species Survey—Monitor Distribution	Completed
2. Begin annual surveys across various portions of NTTR to identify and map locations of chuckwalla habitat and live individuals. Concentrate on areas supporting potential habitat based on soils, geology, elevation, and vegetation.	1,2	Candidate Species Survey—Monitor Distribution	Annual

4.9.2.6.6 References

Dames and Moore. 1994. Herpetological Study in the Indian Springs and Three Lakes Valley Nellis Air Force Range.

Nellis Air Force Base. 1994. Final Report of Biological Study in Area II of Nellis Air Force Base.

Nellis Air Force Base. 2002. Draft Environmental Baseline Study: Nellis Terrace Housing Area. Nellis Air Force Base, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Manch Manor Housing Area. Nel-

lis AFB, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Dunning Circle Housing Area. Nellis AFB, Nevada.

Nevada Environmental Consultants, Inc. 1998. Biological Assessment: Bureau of Land Management Lands Selected for Withdrawal. Nellis Air Force Base, Nevada.

United States Department of the Air Force. 1994. Final Report of Fall and Winter Surveys for Nine Wildlife Species on Nellis Air Force Base Area II. Nellis Air Force Base, Nevada.

4.9.2.7 Banded Gila Monster

4.9.2.7.1 Description of Current Conditions

The banded Gila monster (*Heloderma suspectum cinctum*) is identified as a sensitive species by the BLM and is classified as protected by the state of Nevada. Currently the Clark County Multiple Species Habitat Conservation Plan classifies this species as an "Evaluation - High Priority." Based on available information, this species has not been observed on NAFB or NTTR.

The banded Gila monster is found primarily in the Eastern Mojave Desert of southern California and southern Nevada and the northern Sonoran Desert in northern Arizona. The species is rare, but has been observed in southern Clark County. In this region the banded Gila monster is found primarily in the Mojave Desert Scrub, blackbrush, pinyon juniper, and desert riparian habitats. This species appears to prefer lower slopes of canyons, riparian habitats, and areas with large rocks and deep burrows, which it uses for cover. The banded Gila monster is one of the few venomous lizards in the world, and it feeds primarily on small mammals, birds, and eggs.

4.9.2.7.2 Needs Assessment

At the present time, the banded Gila monster has not been observed on NAFB or NTTR but is known to be present in the area. Any observations of Gila monster should be recorded in the natural resource database.

4.9.2.7.3 Management Goals within the Mission

GOAL 1: Work with Range Operators to avoid or minimize impacts to the banded Gila monster where practical.

GOAL 2: Incorporate any information concerning sightings of the banded Gila monster in the natural resource database for use in base planning.

4.9.2.7.4 Management Guidelines

The military mission always takes precedence over the guidelines recommended in the INRMP. Managers should adhere to the guidelines within the constraints of the mission.

- **If a banded Gila monster is verifiably observed or has been verifiably observed in the area of a mission action, Resource Managers will work with Range Operators to avoid or minimize impacts to the banded Gila monster where practical.**
- **Any observations or other useful information concerning the banded Gila monster should be incorporated into the natural resource database.**

4.9.2.7.5 Projects

Project	Goal	Project No.	Due Date
1. Conduct a thorough review of NDOW and NTTR/NAFB reports to determine if the banded Gila monster has been sighted on NTTR or NAFB. Any information concerning sightings, either historic or current, should be incorporated into the natural resource database.	2	Candidate Species Survey—Monitor Distribution	Jan. 2008
2. Conduct surveys on an annual basis to locate Gila monsters and banded Gila monster habitat. This could be conducted in conjunction with other surveys.	1,2	Candidate Species Survey—Monitor Distribution	Annual

4.9.2.7.6 References

Nellis Air Force Base. 1994. Final Report of Biological Study in Area II of Nellis Air Force Base.

Nellis Air Force Base. 2002. Draft Environmental Baseline Study: Nellis Terrace Housing Area. Nellis Air Force Base, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Manch Manor Housing Area. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Dunning Circle Housing Area. Nellis AFB, Nevada.

Nevada Environmental Consultants, Inc. 1998. Biological Assessment: Bureau of Land Management Lands Selected for Withdrawal. Nellis Air Force Base, Nevada.

United States Department of the Air Force. 1994. Final Report of Fall and Winter Surveys for Nine Wildlife Species on Nellis Air Force Base Area II. Nellis Air Force Base, Nevada.

U.S. Army Corps of Engineers, Omaha District. 2001. Environmental Assessment for Live Ordnance Departure Area. Nellis Air Force Base, Nevada.

4.9.2.8 Phainopepla

4.9.2.8.1 Description of Current Conditions

The phainopepla, a passerine species (songbird), was designated by the State of Nevada as a protected species on April 3, 1997. Males are black, females are a dull gray, and both sexes have distinct red eyes. It is often found in mesquite groves and in washes that support significant stands of cat claw acacia, especially those that include heavy infestations of dwarf mistletoe (*Phoradendron californicum*). Mistletoe berries are its primary food source in such areas during winter. The rapid population growth and urban land development in and around Las Vegas has reduced habitat. Mesquite stands continue to be fragmented, degraded, and ultimately lost. The Desert Wells Annex contains large stands of mesquite with dwarf mistletoe and is expected to support phainopepla. This species is an evaluation species under the MSHCP, and no specific conservation or mitigation measures have been identified to date.

4.9.2.8.2 Needs Assessment

Very little information is currently available concerning the occurrence of phainopepla on NAFB or NTTR. Because the species prefers large stands of mesquite or cat claw acacia containing mistletoe, any areas containing these plants should be designated as potential habitat. To date, the only potential habitat that has been observed is at the Desert Wells Annex, Area II of NAFB, and the southeastern corner of NTTR in the South Range. During vegetation surveys, substantial stands of mesquite and cat claw acacia should be located and listed as potential habitat. This species should be conserved in an effort to prevent its listing as a rare or endangered species. The BLM and Clark County DCP are completing a conservation management strategy document that will aid the USAF with determining potential habitat and developing appropriate management measures.

4.9.2.8.3 Management Goals within the Mission

GOAL 1: To avoid or minimize impacts to Phainopepla and its habitat by mission actions whenever practical.

- **Historic data and the natural resource database should be reviewed to determine if Phainopepla or its habitat have been observed in the project area.**
- **As part of the environmental assessment, the area should be surveyed for Phainopepla if the site contains suitable habitat, which includes dense stands of mesquite and cat claw acaciac-ontaining mistletoe.**
- **If Phainopepla is found to inhabit the project area, as a courtesy, NDOW should be consulted.**

4.9.1.8.5 Projects

Project	Goal	Project No.	Due Date
1. Incorporate any sightings or locations of Phainopepla and any observation of potential habitat into the natural resource database to assist in planning processes for the mission actions. Information concerning identification of the bird and its habitat should be provided to increase the awareness of this species and its potential listing on State or federal endangered and threatened species lists.	1,2	Candidate Species Survey—Monitor Distribution	June 2008
2. Conduct surveys to locate mesquite populations and determine if Phainopepla are present. Once populations are identified, they should be monitored on an annual basis.	1,2	Candidate Species Survey—Monitor Distribution	Annual

4.9.2.8.6 References

Nellis Air Force Base. 2002. Draft Environmental Baseline Study: Nellis Terrace Housing Area. Nellis Air Force Base, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Manch Manor Housing Area. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Water Wells Annex. Nellis AFB, Nevada.

Nellis Air Force Base. 2002. Environmental Baseline Survey Dunning Circle Housing Area. Nellis AFB, Nevada.

4.10 FIRE MANAGEMENT

4.10.1 Description of Current Conditions

Public Law 106-65, Section 3014(d)(1) states "*IN GENERAL- The Secretary of the military department concerned shall take necessary precautions to prevent and suppress brush and range fires occurring within and outside lands withdrawn by section 3011 as a result of military activities and may seek assistance from the Bureau of Land Management in the suppression of such fires.*" As such, the Bureau of Land Management has overall fire management responsibility on

the NTTR. Also, PL 106-65 3014(2) requires the BLM to provide assistance in the suppression of military caused fires and provides for the transfer of funds from Nellis as compensation. Nellis USAF Base has recently terminated the existing Wildlife Fire Support Agreement with BLM. BLM and Nellis USAF Base are currently in negotiations to draft a new agreement. Additionally, NTTR is currently developing an agreement with the Nevada Test Site to jointly fight fires.

The 98th RANW, Mission Support Group Commander (IAW Draft AFI 13-212VI-ACC SUP 1, NAFB Addendum A) is responsible for fire protection and prevention services on the NTTR. The Indian Springs Fire Chief or his designee will act as a liaison between local emergency response forces (typically BLM) and senior wing leadership. The Indian Springs Fire Chief or his designee will also serve as part of a unified command structure along with BLM on all wildland fires beyond Air Force capability. A Wildland Fire Management plan is currently being developed by 99 CES/CEVN in cooperation with 98th RANW. A copy of this plan can be obtained by contacting 99th CES/CEVN. In NTTR, the vegetation most susceptible to fire is the pinyon juniper woodlands and grasslands. Susceptibility to fire increases significantly as the canopy of the woodland closes. Primary causes of fires on NTTR include lightning or military related activities. Lightning is the most common ignition source. Most common military caused ignition sources include ordnance, flares, and aircraft crashes. All of the target areas are located in bare ground or grassland areas and not in pinyon juniper woodlands, so exploding ordnances are not usually a source of fire in these areas. Pinyon juniper woodlands fires are more likely caused by lightning, flares, or aircraft crashes. Uncommon but possible sources include military and authorized access personnel actions including smoking, welding, and equipment related ignitions. Every 8 to 12 years, vegetation in the south range receives sufficient winter rainfall to produce a grass crop that provides enough fuel load to support wildfires, which is common for the Mojave Desert system. In addition, many of the mountainous areas not supporting pinyon juniper support plant communities that are sparse, with minimal litter and fuel biomass.

4.10.2 Needs Assessment

Need: Currently, the fuel load in areas having potential for fire are surveyed or delineated by the BLM. This information should be incorporated into the natural resources database for planning purposes.

Assessment: Because fires can cause extreme damage to the ecosystem and to structures and targets, monitoring of fuel loads and potential fires is extremely important. Fire in the pinyon juniper woodlands is not considered a threat to the ecosystem, but is a threat to structures and targets in those woodland areas. Fire in the low desert area is a threat to the desert tortoise and, therefore, fire size should be minimized. As previously discussed, NAFB has terminated the Support Agreement, and there is no current MOA. BLM and Nellis propose to draft a new Agreement that could provide assistance with delineation of fuel loadings that are a threat to military structures and targets. Those areas may require prescribed burns to decrease fuel loads and potential for catastrophic fires. In addition, locations where fires have occurred should also be recorded. All of this information should be entered into the natural resource database.

4.10.3 Management Goals

GOAL 1: Assist the BLM Fire Management Office in monitoring and mapping areas with high potential for causing catastrophic fires. Document and record locations of any fires occurring on NTTR or NAFB and enter the data into the natural resource database.

GOAL 2: Assist the Fire Chief in identifying and developing potential sources of funding for wildfire management training.

GOAL 3: BLM and Nellis should explore opportunities to collaborate to fund and implement identified hazardous fuels reduction treatments that would serve to protect military structures and targets.

4.10.4 Management Guidelines

The military mission always takes precedence over the guidelines recommended in the INRMP. Managers should adhere to the guidelines within the constraints of the mission.

In an effort to provide fire management for NTTR and NAFB, personnel should implement a fire management plan.

Funding sources for fire management training should be investigated.

4.10.5 Projects

Project	Goal	Project No.	Due Date
1. NTTR should survey vegetation communities with respect to their potential for conducting fires.	1,3	New: Vegetation/Soils/ Geologic Surveys	Annual
2. WFMP development and implementation should be closely coordinated with the Fire Chief and 98th RANW. The installation NR professionals, Fire Chief, and Range Control Officers should also coordinate the WFMP development with BLM. The WFMP should be adopted by NTTR and NTTR personnel provided training for proper fire management.	2	New: Wildfire Management Plan/Training	June 2008
3. The Fire Chief has the responsibility for funding for and frequency of wildland fire fighting training. 99th CES/CEVN should work closely with the Fire Chief and staff to identify and address current and new wildland fire staff support, training, vehicle, and program funding needs.	2	Wildfire Management Training	June 2008
4. Document and record locations of any fires occurring on NTTR or NAFB and enter the data into the natural resource database.	1	Range, GIS Database and Aerial Photography	Annual

4.10.6 References

United States Department of the Interior, Bureau of Land Management, Las Vegas District. 1992. Nellis Air Force Range Resource Plan and Record of Decision. Nellis Air Force

Base, Nevada.

U.S. Fish and Wildlife Service. 2003. Environmental Assessment, Wildland Fire Management Plan, Desert National Wildlife Refuge.

4.11 PEST MANAGEMENT

Please refer to the pest management plan that has been developed for NAFB and NTTR. This plan can be obtained by contacting 99th CES/CEVN.

4.12 INVASIVE SPECIES

4.12.1 Description of Current Conditions

BLM, NDOW, and USFWS are all involved in various projects to identify and control noxious and some invasive plants. NAFB and NTTR should work cooperatively with these agencies in finding and controlling noxious and invasive plants on their properties. The only noxious weed known to occur in NTTR and NAFB is salt cedar *(Tamarix ramosissima)*. This plant is very prolific and releases salt in the soil surrounding its roots, which suppresses growth of any other plants. Salt cedar stands can be quite large, and the plants tend to be very competitive for water use, often out-competing any other plants in the area. On NTTR, these plants are not widespread due to the fact that they are adapted to wetter environments. Thus, they are basically restricted to riparian corridors and wet areas. Other noxious weeds known to occur in the area of the NTTR include poison hemlock, Russian knapweed, spotted knapweed, tall whitetop, Dalmatian toad flax, whitetop, Canada thistle, musk thistle, and scotch thistle. Resource managers should be aware of these species and constantly monitor areas to prevent and control infestations.

Cheatgrass, red brome, halogeton, and Russian thistle are four invasive species that are currently inhabiting NTTR. Cheatgrass has the widest distribution and is found throughout the North Range. Red brome is mostly restricted to valley bottoms and alluvial fans in the South Range. Both of these grasses are closely tied to soil disturbances by man's activities. Halogeton appears to be restricted to areas that are either regularly or severely disturbed and do not contain a perennial plant component, or on undisturbed sites that have saline soils and low cover from native perennial species. Russian thistle appears to be restricted to areas that are regularly or severely disturbed, such as roadsides, or to sites with sandy soils and a low density of perennial plants.

At the current time, no invasive animals have been identified on NAFB or NTTR. However, Norwegian brown rats may be present in or around buildings on the base. Cowbirds may also be present on base and on NTTR and NAFB, especially in areas where a water source is present.

Across the NTTR, roads are periodically graded, especially along the shoulders where traffic does not occur. These shoulders become infested with invasive species, especially Russian thistle and halogeton. In addition, road maintenance equipment and other excavating equip-

ment serve as vectors for the spread of the invasive species. Equipment should be thoroughly cleaned before moving to a new location.

In general, the warm, dry climate of NAFB and NTTR is not favorable for many pests and diseases. Preventative maintenance measures are usually sufficient to reduce or eliminate the occurrence of organisms that will threaten turf areas. Occasional application of pesticides is described in the NAFB Base Pest Management Plan.

Although a variety of pest and noxious plant control methods are available, the use of pesticides and herbicides is frequently the easiest available method and should be coordinated with the appropriate land management agencies. On NTTR, use of pesticides should be coordinated with the BLM Weeds Coordinator. Concern over extensive use of these persistent, sometimes toxic materials and their detrimental effects on human health, wildlife resources, and other environmental components require continuous professional review and training. Selection and application of sound central measures must be followed in their use. Pesticides are unique chemicals because they are purposely released into the environment to control pest plants or animals, but they or their breakdown products may become environmental contaminants. Expert application not only determines the chemicals released, but also minimizes their adverse environmental impact. Responsible pesticide use includes judicious use of pesticides at the proper time and application rate adhering to the label directions. Program emphasis shall ensure professional management of installation pest management programs; control application by, or under the supervision of, trained and certified personnel; use of cost-effective strategies; and use of approved pesticides and equipment.

4.12.2 Needs Assessment

At the present time, very few data exist on the location of invasive species populations at NTTR or NAFB. During vegetational surveys, this information should be collected because of the potential of these species to negatively impact the environment.

4.12.3 Management Goals within the Mission

GOAL 1: Identify and monitor populations of invasive plants and animal pests.

GOAL 2: Remove or control invasive plants and animal using methods that minimize impacts to non-target organisms.

4.12.4 Management Guidelines

The military mission always takes precedence over the guidelines recommended in the INRMP. Managers should adhere to the guidelines within the constraints of the mission.

In an effort to control or minimize invasive species and pests on NTTR and NAFB, the following steps should be taken:

- **Populations of invasive plant species should be identified and mapped. The maps should be incorporated into the natural resource database.**
- **Air Force personnel should follow the NAFB Pest Management Plan for controlling invasive and noxious plant and animal species.**

- **Off-road vehicle use should be minimized whenever possible to decrease the spread of red brome, Russian thistle, halogeton, and cheatgrass.**
- **Wherever possible, maintenance of road shoulders should be minimized to decrease spread of Russian thistle. Those areas should be managed to develop native plant populations.**
- **Excavation and construction equipment should be cleaned thoroughly before leaving the site and traveling elsewhere on NTTR or NAFB.**
- **99th CES should be notified if any Air Force personnel find an invasive species population, or an extensive area of dead or diseased plants.**

4.12.5 Projects

Project	Goal	Project No.	Due Date
1. During the vegetation surveys, populations of invasive plant species should be noted and mapped.	1	New: Vegetation/Soils/ Geologic Surveys	Annual
2. Any invasive species should be mapped using GPS and data entered into the natural resource database for use in planning.	1	Range, GIS Database and Aerial Photography	Annual

4.12.6 References

National Invasive Species Council. 2001. Meeting the Invasive Species Challenge: National Invasive Species Management Plan.

Nellis Air Force Base. nd. Invasive Plant Management Program. Nellis AFB, Nevada.

4.13 DOMESTIC ANIMALS

New grazing allotments are prohibited on NTTR and NAFB. The only current grazing allotment on NTTR is located on the withdrawn portion of the Bald Mountain allotment. Therefore, this section of the INRMP is not applicable.

4.14 CULTURAL RESOURCES

The management of cultural resources is covered by a Cultural Resources Management Plan that has been recently prepared for NAFB and NTTR. The reader is directed to that document for any information concerning cultural resources. A copy of this plan may be obtained through 99th CES/CEVN.

4.15 HAZARDOUS WASTE MANAGEMENT

NTTR and NAFB currently have a hazardous waste management plan in force. The reader is directed to that document for details on hazardous waste management. A copy of this plan may be obtained through 99th CES/CEVN.

THIS PAGE IS INTENTIONALLY LEFT BLANK

5.0 OVERALL MANAGEMENT PLAN

5.1 SENSITIVITY MAP

Once the natural resource database has been established and baseline data has been incorporated, a sensitivity map should be developed to assist NAFB/NTTR planners in determining locations for mission activities. In creating sensitivity maps, the resource manager must review all natural resources on NTTR and NAFB and score them according to their level of sensitivity to direct and indirect activities. For example, a soil map would typically show the different soil types encountered on NTTR or NAFB. A sensitivity map for soils would score each soil type according to sensitivity to impacts, and each soil type would then be replaced by a score. Each natural resource would have a separate layer with scores for use in a final sensitivity model. All natural resource layers would then be mathematically added according to their scores, creating an overall sensitivity map where high scores would represent extreme sensitivity and low scores would represent low sensitivity. Using this map, NTTR managers could site mission actions in areas where sensitivities are low and impacts to the environment would be expected to be minimal.

5.2 LAND USE RECOMMENDATION MODEL

Once a sensitivity model has been developed, the natural resource manager can then use these scores to assist planners and operators in achieving mission objectives while minimizing impacts to natural resources. The natural resource manager would work in consort with the operators to minimize impacts to sensitive resources; however, sometimes a resource must be impacted to accomplish a mission. This is an excellent tool for siting facilities based on the natural resources available on the project area. Thus, using sensitivity scores, areas can be categorized as to appropriateness for facility development, roads, trails, targets, and other features commonly used by the mission. This tool not only allows planners to easily site their projects, but it often results in expeditious initiation of projects by avoiding impacts that could potentially result in lengthy permitting and/or negotiations with federal and state agencies.

5.3 PILOT STUDY

Once the natural resource database has been properly developed and standard protocols for data collection have been created, a pilot study for a small portion of NTTR should be conducted to ensure that the sensitivity model and land use recommendation model are valid. Thus, a great deal of labor working on a model for an area as large as NTTR could be avoided, and problems in the model can be much more easily addressed on a smaller scale. Therefore, it is recommended that a pilot study be conducted for the South Range and for the North Range, mainly due to the difference in the environments and the natural resources encountered in those environments.

5.4 UPDATING THE DATABASE

In creating the natural resource database, specific protocols for information on each natural resource layer should be developed. These protocols will delineate the data that should be collected for each natural resource and will also detail how the data should be collected in the field. This procedure is critical in that it ensures that data will be uniform and that all data collected will

be usable in the natural resource database. Data should be incorporated into the natural resource database as soon as possible after it is collected. This way the database remains current, data are not lost, and data incorporation does not become a huge task.

5.5 NEEDS ASSESSMENT

As was previously discussed in the GIS section, an area as large as NTTR definitely requires a current, well-developed natural resource database to accompany the INRMP and make it a usable tool for the planners. Development of the GIS database may be somewhat expensive upfront, but it will save an enormous amount of funding in the future. Hours of lost labor due to poor siting of facilities and lack of information on natural resources in the area will be completely avoided. The key is to have a good, well-planned database containing high-quality, current data. Ideally, initiation of the project to create a natural resources GIS database should be completed by December 2006, pending collection of data. Some layers will not be available due to the fact that it will take several years to collect these data. These data can then be incorporated as they are collected.

It is important to note that development of a GIS database such as this does not have to be an extremely expensive endeavor. With current GIS technologies, multi-million-dollar database projects have been reduced to projects that may even be less than $100,000, depending upon the scope. Natural resource data do not require the precision of typical engineering projects and, therefore, much of the protocol required for CAD design and engineering database development is not as critical. Therefore, cost can be much less.

6.0 PROGRAMS

6.1 OUTDOOR RECREATION

6.1.1 Objectives

The objective of an outdoor recreation program at a natural area is to provide opportunities for the public and military personnel to use and observe natural resources on the site. However, because of security and safety reasons, opportunities for outdoor recreation are very limited. At NAFB, some potential for outdoor recreation exists, but again this is limited because of security and safety.

6.1.2 Military Mission Considerations

Because of security and safety issues, the only planned outdoor recreation on NTTR are two scheduled desert bighorn sheep hunts that are conducted during November and December.

6.1.3 Public Access

The NTTR was withdrawn from DoI's public lands for use by the Department of the Air Force under Public Law 106-65, The Military Lands Withdrawal Act of 1999. This legislation discusses non-military use of the withdrawn lands. In accordance with the Military Lands Withdrawal Act of 1999, Section 3014, Management of Lands (a)(3) NONMILITARY USES (A) IN GENERAL, "All nonmilitary use of the lands referred to in paragraph (2), other than the uses described in that paragraph, 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."

In accordance with this referenced section, the NTTR lands are closed to non-military access based on three factors: (1) to protect the public from injury due to ordnance hazards; (2) to ensure national security is not compromised; and (3) to ensure that military programs can be conducted without interruption.

Access can be granted to specific personnel who have been cleared for security through proper channels. With only a few exceptions, most civilians not employed by the Air Force or DOD cannot access a majority of NTTR and NAFB without a military or government escort. Access for escorted civilians is also limited at NTTR by scheduling of mission operations. With proper planning, access for various surveys by state and government officials can be granted. For example, large game surveys using helicopters or fixed-wing aircraft can be scheduled but require at least two weeks' notice with Range personnel. Often these activities must occur on weekends when military operations are not being conducted.

It is important to note that the lack of public access is not meant to be detrimental to development of cooperative efforts between the Air Force, NDOW, USFWS, and BLM. The Air Force is very interested in these relationships, but for security and safety reasons, access must be under strict control.

6.1.4 Hunting Programs

For approximately two to three weeks in fall to early winter, areas on the North (Stonewall Mountain) and South Ranges are opened to small groups of permitted desert bighorn sheep hunters. After receiving EOD training from the Air Force, hunters who have been issued tags are permitted to hunt in select areas normally off-limits to the public. Law enforcement issues associated with the hunts are the responsibility of NDOW. The only user fee activities on NTTR are the desert bighorn sheep hunts and the fees are collected by NDOW.

6.1.5 Other Natural Resources Oriented Outdoor Recreation

No other natural resources oriented outdoor recreation is available at NTTR or NAFB at this time.

6.2 SAFETY AND SECURITY

As part of the force protection at NAFB and NTTR, specific protocol must be followed for base security. Major guidelines are discussed below.

Entry into the NTTR and 98th RANW facilities is limited due to its sensitive nature and safety considerations. All visitors who require access to NTTR must submit a NAFB Form O-74 or visit request letter, sensitive equipment request, and camera permit request at least 10 working days prior to the visit to their 98th RANW Point of Contact (POC)/Sponsor for each visit. For unescorted access to any 98th RANW controlled area, visitors must have a minimum of a current valid secret security clearance.

Visit requests will contain the following:

- Name
- Rank
- Social Security Number
- Security clearance (must be at least Secret)
- Job title
- Date and place of birth
- If a naturalized citizen, provide naturalization number, port of entry, and date
- Organization
- Dates of visit (inclusive)
- Purpose of visit (in detail)
- Mode of transportation
- Entry and exit locations
- The 98th RANW project officer/POC name

The following items are considered sensitive equipment:

Recording or copying devices of any type

- Cell phones with imaging capabilities
- Electronic equipment with a data exchange port which could be used to connect Automated Information System (AIS) Equipment (excludes pocket calculators, wristwatches, data diaries, etc. not equipped with a data exchange port)

- Computers and associated hardware
- Cameras and photographic equipment
- Binoculars and optical magnifying equipment
- Night vision devices
- Radios
- Firearms
- Weapons
- Munitions

Only the 98th RANW/CC/CV or 98th RANW/XPS representative can approve use of cameras on the NTTR. Camera permits are issued in accordance with sensitive equipment procedures. Range visitors requiring a camera to meet mission requirements must submit requests to the Project Officer/POC. Photographs or other images will be limited to those required to meet the specific mission for which the permit was issued. Un-cleared visitors will not be issued a camera permit; however, their sponsor/escort may obtain a permit and take the mission required photos. All film, photographs, and images must be reviewed by the 98th RANW Project Officer/POC, Det Commander or 98th RANW/XPS prior to being removed from the NTTR.

Basic rules for photography on the NTTR include:

1. The escort/camera pass holder is responsible for all photographs taken.
2. Photographs taken are to be limited to the specific areas requested.
3. Wide panoramic views of the horizon and surrounding areas will be avoided to the maximum extent possible.
4. Escorts must be sensitive to any shots that may capture airborne platforms or ground facilities/equipment.
5. All photographs will be presented to the 98thth RANW POC for security review. Photographs may not be incorporated into a project or used in any way prior to 98th RANW approval of the photos.
6. Any deviation to the above must be coordinated through the 98th RANW POC.

6.3 EDUCATION AND INTERPRETIVE PROGRAMS

6.3.1 Objectives

The objective of a public education/interpretive program is to make the public and military personnel aware of the natural resources available at NTTR and NAFB. Overall, this awareness is developed to encourage military and civilians to have respect for nature and many of the natural resources on Base.

6.3.2 Military Personnel/Contractor Awareness Training

An important part of natural resource management is educating military and civilian personnel with access to NTTR and NAFB about various aspects of the natural resources found in those areas. Some of the topics that should be included in military personnel awareness training include the following:

- Identification of endangered or threatened species.
- Identification of species of concern.
- Proper procedure for notifying the natural resource manager of dead or diseased animals. This would include training to be able to identify diseased animals.

- General environmental etiquette on NTTR, including minimizing non-mission related off-road travel, respect for plant and animal life, proper disposal of trash and other debris, and other similar topics.

This type of awareness program can make natural resource management on NTTR a team effort versus an effort only addressed by the natural resource manager and his employees.

6.3.3 Public Awareness

An important part of the public relations component of natural resource management on a highly secured base such as NAFB and NTTR should include public awareness. Whenever possible, the public should be provided with information concerning how the Air Force is addressing environmental problems and conserving natural resources. Although the public cannot access NTTR, documentaries could be developed that may highlight some of the more interesting natural resources found on NTTR without jeopardizing security and other issues.

6.4 REFERENCES

United States Department of the Interior, Bureau of Land Management, Las Vegas District. 1992. Nellis Air Force Range Resource Plan and Record of Decision. Nellis Air Force Base, Nevada.

U.S. Army Corps of Engineers, Omaha District. 2001. Environmental Assessment for Live Ordnance Departure Area. Nellis Air Force Base, Nevada.

7.0 IMPLEMENTATION

7.1 WORK PLANS

Initially, the INRMP may appear to be a very aggressive program for managing the resources at NAFB and NTTR. However, review of the past reports for the area clearly indicates that the current data and mapping of NTTR is minimal, outdated, and full of gaps and unverified data. It is paramount that the USAF initiate an aggressive program to bring the natural resources program at NAFB and NTTR to a management level that is comparable to other Air Force bases in the U.S. NTTR supports a desert/mountain ecosystem that requires extensive management to conserve natural resources in a manner consistent with the goals and objectives stated in AFI 32-7064 and the Sikes Act. The next five to ten years are critical to bring NTTR and NAFB to a desired level of compliance.

Throughout the INRMP, projects were presented to meet the objectives and goals of each management area. Table 7-1 provides a list of the major projects to be funded in support of the INRMP. The table includes the name of the project, the project number (if it has been assigned), federal regulations driving the project, and the recommended priority level. Table 7-2 lists the proposed funding for each of the projects over the period from 2005 to 2011. Table 7-3 provides a summary of the general tasks required for each project.

TABLE 7-1
Proposed Projects to Support the INRMP Listed in Order of Priority, Priority Level (1, 2, or 3 with 1 being the highest priority), and the Regulatory Drivers for Each Project

Project Name	Regulatory Drivers	Priority
Habitat Management, Desert Tortoise	Sikes Act; AFI 32-7064; Endangered Species Act; Military Lands Withdrawal Act of 1999; USFWS Biological Opinion File No. 1-5-02-F-522	1
Range, Survey, Update Desert Tortoise	Sikes Act; AFI 32-7064; Endangered Species Act; Military Lands Withdrawal Act of 1999; USFWS Biological Opinion File No. 1-5-02-F-522	1
Range, GIS Database and Aerial Photography	Sikes Act; AFI 32-7064	1
Range, Annual Plan Revision, INRMP	Sikes Act; AFI 32-7064	1
Range, Survey, Monitor-Maintain, Wetlands/Seeps/Springs	Sikes Act; AFI 32-7064; Section 401 and 404 of the Clean Water Act, Executive Order 11990; AF Order 780.1; North American Wetlands Conservation Act	1
Candidate Species Survey—Monitor Distribution	Sikes Act; AFI 32-7064; Endangered Species Act; Military Lands Withdrawal Act of 1999	2
Survey Monitor Unique Habitats & Rare Plants	Sikes Act; AFI 32-7064; Endangered Species Act; Military Lands Withdrawal Act of 1999Section 401 and 404 of the Clean Water Act; North American Wetlands Conservation Act	2
Range, Migratory/Neo-Tropical Bird Surveys and Evaluations	Sikes Act; AFI 32-7064; Endangered Species Act; Migratory Bird Treaty Act; Bald Eagle Protection Act	2
Survey, Evaluate Distribution of Wildlife/Species at Risk	Sikes Act; AFI 32-7064; Endangered Species Act; Military Lands Withdrawal Act of 1999, Free Roaming Wild Horse and Burro Act	2

Project Name	Regulatory Drivers	Priority
Vegetation/Soils/Geologic Surveys Proposed New Project)	Sikes Act; AFI 32-7064	3
Range, Study, Bat, Species of Concern	Sikes Act; AFI 32-7064; Endangered Species Act; Military Lands Withdrawal Act of 1999;	3

TABLE 7-2
Proposed Projects to Support the INRMP Describing the Justification and Impacts to the Mission by the Projects.

Project Name	Justification	Impact to the Mission if Not Provided
Habitat Management, Desert Tortoise	Overall BO for NAFB and NTTR will expedite the time required for approval of mission activities. Replaces the need for a BO to be prepared by the USFWS for every mission project that potentially impacts the Desert Tortoise.	Would delay the implementation of mission activities and operations as a result of lengthy evaluation of impacts on a case by case basis.
Range, Survey, Update Desert Tortoise	Information is required for the development and implementation of the Desert Tortoise Management Plan and BO.	Desert Tortoise Management Plan could not be completed and expeditious approval of mission activities would not happen.
Range, GIS Database and Aerial Photography	Development of a comprehensive GIS database and aerial photography will provide an invaluable planning tool for NTTR and NAFB to avoid and minimize impacts to natural resource, thereby expediting NEPA, ESA, and other federal processes. Also allows mission planner to be able to locate specific environments that may be required for training troops.	Mission activities will continue to be planned with minimal knowledge of the location and nature of natural resources. Will result in delays to the mission because of non-compliance and impacts to protected species. Ideal locations for training may be missed.
Range, Annual Plan Revision, INRMP	Required by Sikes Act and AFI 32-7064.	NTTR and NAFB will not be in compliance with regulations and will not be current with compliance with federal natural resources laws.
Range, Survey, Monitor-Maintain, Wetlands/Seeps/Springs	According to the CWA, fill material cannot be placed in waters of the U.S. without a Section 404 Permit. Surface waters are rare on NTTR and support many species of concern which may require consultation with the USFWS if they are not conserved today.	Mission activities could be delayed by permitting when minor changes could avoid placing fill in waters of the U.S. Seeps, springs, and wetlands are sensitive environments that should be conserved to prevent the listing of new species.
Candidate Species Survey—Monitor Distribution	Conservation of these species today may prevent their listing in the future.	If these species are listed, mission activities could be significantly delayed or limited because of ESA compliance issues.
Survey Monitor Unique Habitats & Rare Plants	Habitat that supports rare and endangered species is very important in conserving species that could become listed and later protected under the ESA. Fosters a good relationship with NDOW and USFWS.	Prevents or minimizes impacts of the mission to unique habitat that may support rare or endangered species.

Project Name	Justification	Impact to the Mission if Not Provided
Range, Migratory/Neo-Tropical Bird Surveys and Evaluations	Prevent potential BASH issues. The BASH plan specifically requires the monitoring of migratory bird populations. Also, migratory birds are protected by the Migratory Bird Treaty Act and the USAF should still attempt to comply even though they are exempted for military mission activities.	BASH incidences could be prevented to some degree if the locations of bird populations are known. Information on migration routes is needed by NDOW and this would assist in building a good working relationship. Most birds are also protected by state laws.
Survey, Evaluate Distribution of Wildlife/Species at Risk	The nature and distribution of small mammals on NTTR is not known. Information on the distribution and movement of large mammals on NTTR would decrease personnel vehicle safety issues. Species at risk may be present on NTTR, but without studies they could be impacted by mission activities.	Unchecked, mission activities could contribute to the listing of species and, consequently, a delay in the mission could result. Vehicular collisions with large mammals could be minimized.
Survey, Evaluate Distribution of Wildlife/Species at Risk	Assists in the identification of unique habitat and potential habitat supporting species of concern. Also helpful in supporting the mission by providing information useful in finding specific training environments.	Mission planning may not run as smooth without information on the ecology of areas. Locating ideal sites for training would be more difficult.
Range, Study, Bat, Species of Concern	Prevents the potential for BASH and possible take of endangered or threatened species.	Damage to aircraft caused by bats could occur. Take of federal listed species could delay the mission.

TABLE 7-3
Proposed Projects to Support the INRMP and the Tasks Associated with Each Project. Legal authorities, regulatory, and policy drivers for these projects are listed in Table 7-1.

Project	Due Date
Habitat Management, Desert Tortoise	
1. A desert tortoise management plan will be written according to USFWS guidelines.	January 2008
Range, Survey, Update Desert Tortoise	
1. A 100% survey of NAFB should be completed.	Completed
2. A vegetational survey of the South Range valleys should be conducted to determine the presence of suitable or unsuitable tortoise habitat. This will be accomplished by using color aerial photographs and ground-truthing for observation of plant composition and desert tortoise/tortoise sign. The entire area will be mapped, and the map submitted to the USFWS for their opinion and approval. Close coordination with the USFWS is mandatory. Once this portion is complete, the map will be entered into the natural resource database for use in future mission planning.	Completed
3. Monitor mission activities impacting desert tortoise habitat and relocate tortoises displaced by those actions. Monitor relocated tortoises using radio telemetry. Evaluate future tortoise relocation areas and future habitat restorations. Establish an annual monitor and relocation program.	Annual

Project	Due Date
4. Investigate disturbed areas to determine the potential for habitat restoration and develop a habitat restoration program.	Annual
5. Implement habitat restoration program as appropriate	Annual
Range, GIS Database and Aerial Photography	
1. Complete the elevation contour GIS layers for NTTR. Incorporate these into the Natural resource database. Also include seamless USGS quad sheets in UTM NAD 83 Zone 11N.	Completed
2. Using ArcView Spatial Analyst and 3-D Analyst, develop new GIS layers to include topographic features, digital elevation grids, slope, and aspect for NTTR and NAFB.	Completed
3. Using information from GIS layers, a sensitivity map should be developed for topographic features showing location of areas sensitive to development and location topographic characteristics that are not conducive to development. Use this information to assist in maintaining ecological connectivity and to minimize impacts to sensitive or unique topographic features.	December 2007
4. Incorporate currently available maps showing geologic formations, faults, and seismic zones into the Natural resource database.	Completed
5. Continually update the geology layers for the natural resource database as new data is collected and new findings are made. Geotechnical data collected for construction sites should be incorporated into the natural resource database for future reference.	Annual
6. Develop sensitivity zones based on geology to assist in the siting of new construction projects and targets.	Annual
7. BLM is responsible for the soil mapping on the Wild Horse Management Area on the North Range. Consult with BLM to identify areas in the North Range that are scheduled for mapping by BLM and incorporate data into the natural resource database.	December 2007
8. Data collected from the field soil studies should be incorporated into the natural resources GIS database as it is available.	Annual
9. Surface water data should be incorporated into the natural resources GIS database. This will assist planners in avoiding impacts to jurisdictional surface waters that may require permitting with the USACE.	Annual
10. Information on the location and sensitivity of recharge zones should be incorporated in to the natural resources GIS database to allow for project planners to avoid or minimize impacts to those features.	June 2007
11. Incorporate groundwater and spring water quality data into the natural resources GIS database and keep that information updated annually.	Annual
12. Wetland delineation data collected from surveys should be mapped and incorporated into the natural resources GIS database. Wetland information from the Dames and Moore project should be incorporated into the natural resource database. Links to wetland reports should be included, and the reports should be converted into PDF files for reference. Any new wetland data or modifications of old data should be included in the natural resource database. The data should also be converted into sensitivity scoring for use in the GIS database model for natural resource management planning.	December 2006
13. Update the natural resources database with additional information on wetlands and any monitoring data that may be appropriate.	Annual
14. Information from the original floodplain project for NTTR should be incorporated into the natural resources database.	September 2006

Project	Due Date
15. Develop and ground truth a natural resources database layer comprised of GAP data from the State of Nevada to be used as the baseline for development of a sensitivity model for project planning.	December 2007
16. During any projects or surveys conducted by qualified biologists, the species and location of observed amphibians or reptiles should be recorded and entered into the natural resources database.	Annual
17. Past information concerning locations of reptiles and amphibians should also be incorporated into the natural resources database. In addition, a standard protocol should be developed for entering proper information concerning reptilian and amphibious species in the natural resources GIS database.	Annual
18. All past tortoise studies should be incorporated into a uniform database and placed in the natural resources GIS database for use in future planning. Any new studies will also be incorporated into the natural resources GIS database. Results from all studies will be used to develop a sensitivity model for mission planning.	Annual
19. Once the USFWS and the Air Force have come to agreement on suitable and unsuitable desert tortoise habitat, these areas will be delineated and entered into the natural resources GIS database.	Annual
20. Information collected by the TNC 1997 Rare Plant Study should be incorporated into the natural resources GIS database. This information can then be used in developing a sensitivity model for planning purposes of NTTR and NAFB.	Completed
21. During all other surveys and projects at NTTR and NAFB, any burrowing owl habitat or birds should be identified, located, and the data incorporated into the natural resources GIS database. Information from past studies should also be incorporated into the database.	Jan. 2008
22. During any projects or surveys conducted by qualified biologists, the species and location of observed small mammals should be recorded and entered into the natural resources database.	Annual
23. During any projects or surveys conducted by qualified biologists, the species and location of observed large mammals should be recorded and entered into the natural resources database.	Annual
24. Document and record locations of any fires occurring on NTTR or NAFB and enter the data into the natural resource GIS database.	Annual
25. Any invasive species or dead or diseased animals should be mapped using GPS and data entered into the natural resource GIS database for use in planning.	Annual
26. Develop a GIS database from the NBMG report that provides information as to the location and characteristics of mines and borrow pits in NTTR. Data on amount of borrow removed could be included in the database.	Completed
27. Using true color aerial photographs, the South Range should be photographed and analyzed for determination of plant communities. Ground truth work will be conducted in conjunction with the geology and soils surveys.	December 2007
28. Using true color aerial photographs, the South Range should be photographed and analyzed for determination of plant communities.	June 2011
29. Using true color aerial photographs, the North Range should be photographed and analyzed for determination of plant communities every five years. Ground truth work will be conducted in conjunction with the geology and soils surveys.	June 2008
Range, Annual Plan Revision, INRMP	

Project	Due Date
1. Annually update the INRMP to accommodate changes in policies, new data, and revised mapping of natural resources.	Annual
Range, Survey, Monitor-Maintain, Wetlands/Seeps/Springs)	
1. Summarize and map information collected in past studies concerning surface waters and their characteristics. A standard procedure should be developed for uniform entry of data into the GIS database.	June 2007
2. Delineate and map ephemeral streams and washes at NAFB and NTTR. Priority should be made for washes and streams that are jurisdictional (connected to waters of the U.S.). These are the washes and streams at NAFB and on the west side of NTTR.	Annual
3. Delineate and determine the jurisdictional status of all wetlands identified by the 1996 Dames and Moore report to ensure that data and wetland boundaries have been modified to accommodate any changes in the environment since that survey was conducted. The new survey should include all information required by the U.S. Army Corps of Engineers for a standard field determination of wetlands. During the wetland review listed above, aerial photographs and other information should also be reviewed to determine if any new wetlands or wetlands not covered by the survey require delineation and documentation.	2007-2008
4. Wetlands and associated plant communities should be evaluated and monitored annually to assess ecosystem health.	Annual
5. Evaluate and delineate wetlands associated with springs and seeps in NTTR. Monitor the quality of the water in the springs and wetlands. Vegetation and wildlife populations supported by these areas should be characterized and monitored. Each site should be delineated according to USACE guidelines.	Annual
6. Floodplains within NAFB should be either mapped, or maps should be obtained. This information is critical for planning mission activities and preventing damage to equipment and personnel.	December 2008
7. Mission activities involving construction or excavation in 100-year floodplains since 1996 should be reviewed to determine if those activities altered the floodplains. If alterations are identified, floodplains should be remapped, and the data should be incorporated into the natural resources GIS database.	Annual
8. Floodplain maps for NTTR should be verified, expanded, and corrected. Corrections should be incorporated into the natural resources GIS database.	December 2010
9. Evaluate, delineate, and monitor springs, seeps, and wetlands in NTTR. Monitor the quality of the water in the springs, seeps, and wetlands. Vegetation and wildlife populations supported by these areas should be characterized and monitored.	2007
10. Annual evaluation and monitoring of springs and seeps.	Annual
Candidate Species Survey—Monitor Distribution	
1. Conduct helicopter surveys of the North Range, especially the Kawich Mountains, to determine if sage grouse and/or big sage plant communities are present in the area. Any information collected during the survey should be incorporated into the natural resource database.	Completed

Project	Due Date
2. If sage grouse populations are identified during the aforementioned survey, strutting ground surveys and continued monitoring of those populations should be conducted annually to monitor the distribution, depredation, reproduction, population status and trends and mortality of sage grouse populations on NTTR.	Annual
3. If during surveys and projects, any candidate reptile or amphibian species are identified, additional surveys should be conducted to determine their distribution on NAFB and NTTR.	Annual
4. During sage grouse and vegetation surveys, areas supporting big sagebrush should also be surveyed for pygmy rabbit. This project should take a high priority due to the fact that the pygmy rabbit is a listed endangered species in Oregon and may require consultation with the USFWS if its habitat or presence is identified in an area impacted by the military mission. Pygmy rabbit habitat and location of any pygmy rabbits or rabbit burrows should be located using GPS equipment and data incorporated into the GIS database. Using this information, areas potentially supporting the pygmy rabbit can be identified and mapped for planning purposes.	June 2007
5. Develop a pygmy rabbit management plan for NTTR.	June 2008
6. Annual burrowing owl surveys should be conducted in areas supporting habitat conducive to burrowing owls to locate owl populations on NAFB and NTTR. Known populations should be monitored on an annual basis.	Annual
7. Collect any information from on-base and off-base sources that may assist in locating areas where the chuckwalla has been observed on or near NTTR or NAFB.	Completed
8. Begin annual surveys across various portions of NTTR to identify and map locations of chuckwalla habitat and live individuals. Concentrate on areas supporting potential habitat based on soils, geology, elevation, and vegetation.	Annual
9. Conduct a thorough review of NDOW and NTTR/NAFB reports to determine if the banded Gila monster has been sighted on NTTR or NAFB. Any information concerning sightings, either historic or current, should be incorporated into the natural resource database.	Jan. 2008
10. Conduct surveys on an annual basis to locate banded Gila monsters and banded Gila monster habitat. This could be conducted in conjunction with other surveys.	Annual
11. Incorporate any sightings or locations of Phainopepla and any observation of potential habitat into the natural resources GIS database. This information will be used to assist in planning processes for the mission actions. Information concerning identification of the bird and its habitat should be provided to NAFB and NTTR planners to increase the awareness of this species and its potential listing on state or federal endangered and threatened species lists.	December 2006
12. Conduct surveys to locate mesquite populations and determine if Phainopepla are present. Once populations are identified, they should be monitored on an annual basis.	Annual

Project	Due Date
Survey Monitor Unique Habitats & Rare Plants	
1. Previously identified Las Vegas bearpoppy, Las Vegas buckwheat and other rare plant populations should be surveyed and monitored to determine if plants are still present. Information should be entered into natural resource database. The location of live, dead, or dormant plants should be included.	Annual
2. During soil surveys, any gypsiferous soils should be identified as potential habitat for the Las Vegas bearpoppy and Las Vegas buckwheat. Those areas should then be surveyed for the presence of either of these species. If plants are identified, their locations should be entered into the natural resources database.	Annual
3. Identified Las Vegas bearpoppy populations should either be fenced or carefully marked for easy identification to avoid impacts by any action on NAFB or NTTR. NAFB personnel should be educated as to the identification of bearpoppies and Las Vegas buckwheat if projects or mission actions are to occur in the areas supporting established populations.	Annual
4. Update and validate TNC rare plant study.	Annual
5. Initiate annual monitoring of rare plant populations identified by TNC. Record population location by GPS and provide descriptive information to monitor growth and health of the population.	Annual

Project	Due Date
3. Qualified biologist surveying or conducting projects within NTTR should always note the location and species of raptors or raptor nests observed. This information should be noted on maps and incorporated into the natural resource database. Additionally, any observations of waterfowl and other birds should also be noted and incorporated into the database. Over time, this information will provide excellent baseline for determining potential dangerous areas for flight paths.	Annual
Survey, Evaluate Distribution of Wildlife/Species at Risk	
1. Whenever possible, qualified biologists conducting projects or surveys at NAFB or NTTR should be asked to record the location and species of any mammals observed. This information should be recorded and incorporated into the natural resource database. Such information will be especially helpful in providing information to NDOW and the USFWS concerning the distribution and ecological function of mammals in southern Nevada and for the identification of indicator species to be used in future natural resource management of the area.	Annual
2. Delineate a minimum of 20 sampling sites across NTTR and 4 sampling sites on NAFB to conduct small mammal live trap surveys to assist in determining the health of the overall ecosystem. Number of sites or location may be changed each year, but surveys will be conducted on a continuing basis.	Annual
3. Conduct annual surveys for small mammals with an emphasis on riparian areas, seeps, springs, and other habitats to evaluate and determine the seasonal distribution of small mammals in NTTR and NAFB.	Annual
4. A standard protocol for managing dead or diseased animals and for providing access to BLM/NDOW veterinarians to remove and investigate the dead animal should be developed.	Completed
5. Set up utilization cages within the wild horse exclosures to monitor antelope and mule deer range use.	June 2008
6. Evaluate the level of range use within and outside of the mule deer/antelope utilization cages and the wild horse exclosures on a quarterly basis to determine range use by large mammals and wild horses.	Annual
7. Annual desert bighorn sheep surveys should be continued in cooperation with NDOW in the Stonewall Mountain, Pahute Mesa, Tolicha Peak/Quartz Mountain/Thirsty Canyon, Cactus Range, Spotted Range, Pintwater Range, Desert Range, Pahranagat Range, and the East Desert Range. These surveys will provide baseline data for management considerations, such as population characteristics, status, and trends and animal migration studies.	Annual
8. Mule deer should be inventoried in the Belted Range, Kawich Range, Stonewall Mountain, Pahute Mesa, and Groom Range. Surveys could be conducted in cooperation with NDOW and jointly funded by NDOW and the US Air Force. During the surveys, locations and movements of other large game and wildlife/raptors could be conducted. These surveys will provide baseline data for management considerations, such as population characteristics, status and trends, and animal migration studies.	Annual

Project	Due Date
9. Pronghorn antelope should be surveyed in Kawich Valley, Cactus Flat, Reveille Valley, Gold Flat, and Pahute Mesa. These surveys could be conducted between NDOW and the Air Force. The agencies could share in providing labor and funding for each of these surveys. Antelope surveys should be conducted at least every two years. These surveys will provide baseline data for management considerations, such as population characteristics, status and trends, and animal migration studies.	Annual
10. Mule deer, pronghorn antelope, and bighorn sheep surveys can be accomplished jointly with NDOW to provide for more efficient use of funding and labor. These surveys should be carefully planned to allow for proper access and use of helicopters or fixed-wing aircraft. If possible, the same survey crew of qualified biologists should be used to conduct the surveys to provide consistency in data collection and results.	Annual
13. Develop close communication and cooperation with USFWS and NDOW for the monitoring of large game and other wildlife. Beginning in January of 2005, these agencies should develop standard protocols and open communications for surveying wildlife on NTTR.	Annual
Vegetation/Soils/Geologic Surveys (New Annual Project)	
1. Map and delineate geologic formations, soils, and vegetation located in NTTR and NAFB using current geologic maps, aerial photography and ground-truth data. During these geologic assessments, recharge features should be identified and mapped. This project will be an on-going project that will concentrate on each range area prioritized according to the level of impacts impinged by the current activities. In the time frame of this INRMP, the following areas should be mapped and incorporated into GIS:	
a. Range 62S and 62N	Dec. 2008
b. Range 76	Dec. 2009
c. Range 65S and 65N	Dec. 2010
d. Range 74A, 74B, and 74C	Dec. 2011
e. Range 64A, 64B, 64C and 64D	Dec. 2012
f. Range 71N and 71S	Dec. 2013
2. Complete mapping of soils in Area II at NAFB as well as any other portions of the NAFB that have not been mapped.	June 2007
3. NTTR should assist the BLM Fire Management Office in surveying vegetation communities with respect to their potential for conducting fires.	Annual
4. In consultation with BLM, a standard fire management plan should be adopted by NTTR and NTTR personnel provided training for proper fire management.	December 2007
5. During geologic assessments, recharge features should be identified and mapped.	Annual
6. During the vegetation surveys, populations of invasive plant species should be noted and mapped.	Annual
7. The natural resource manager should annually review the landscaping and pest management plans to ensure that natural resources will not be impacted.	Annual
8. Develop a list of woody and herbaceous species that can be planted on NAFB and NTTR.	December 2007

Project	Due Date
9. Develop a course for identification of invasive species to be taught to the grounds maintenance personnel in an effort to identify the location of species and methods to eradicate them. The course should include identification and control methodologies.	June 2008
Range, Study, Bat, Species of Concern	
1. Bat roosting areas potentially impacted by mission activities should be surveyed to determine if bats are present and to determine the composition of the bat populations. Whenever possible, bats should be removed from those roosts and transported to another location.	Annual
2. Airfields should be surveyed for potential roosts and bat activity in an effort to minimize BASH issues associated with active bats.	Annual
3. Coordinate with NDOW, USFWS, BLM, NRCS, and USGS to complete the inventory of NTTR and NAFB for bat species.	Annual
Range, Study, Bat, Species of Concern	
1. WFMP development and implementation should be closely coordinated with the Fire Chief and 98th RANW. The installation NR professionals, Fire Chief, and Range Control Officers should also coordinate the WFMP development with BLM. The WFMP should be adopted by NTTR and NTTR personnel provided training for proper fire management.	June 2008
2. The Fire Chief has the responsibility for funding for and frequency of wildland fire fighting training. 99th CES/CEVN should work closely with the Fire Chief and staff to identify and address current and new wildland fire staff support, training, vehicle, and program funding needs.	June 2008

7.2 NATURAL RESOURCES MANAGEMENT STAFFING

Currently, NAFB and NTTR have the following positions devoted either full time or part time to natural resources management:

- Natural Resources Manager: Devoted full time to the management of natural resources on NAFB and NTTR. Coordinates all activities at both locations to ensure that natural resources are conserved without significantly impacting the goals and objectives of the military mission. Coordinates mission activities with appropriate state and federal regulatory agencies when required. Ensures that NAFB and NTTR fully comply with the goals, objectives, and management guidelines stated in the INRMP.
- Land Manager: Assumes full responsibility for the tree program and the invasive plant control program at NAFB and NTTR. Assists the Natural Resources Manager in ensuring that NAFB and NTTR fully comply with the goals, objectives, and management guidelines provided in the INRMP.
- NEPA Manager: Coordinates all activities potentially impacting the environment and requiring preparation of environmental assessments or environmental impact statements. Coordinates these activities with the Natural Resources Manager as necessary.
- Conservation Specialist: Assists the Chief Natural Resources Manager, Land Manager, and the NEPA Manager whenever necessary.

The previous section contained tables that listed project work plan for the INRMP for the next

six years. It is obvious that the current staff will be unable to accomplish this workload. Projected staffing requirements to meet the goals and objectives of the INRMP exceed ten full-time positions each year. Presently, most of the responsibility for resource management falls on the Natural Resources Manager, who spends most of his time addressing Air Force activities potentially impacting natural resources and coordinating the activities of contractors and regulatory agencies involving natural resources management. Most of the surveys, reports, and monitoring being conducted at NTTR and NAFB are accomplished on a contractual basis with independent consultants.

In an effort to alleviate the lack of staffing to support natural resources in the future, the following plan for incorporation of new positions to support natural resource management is proposed:

- By December 2006, natural resources management staff should be increased by the following two positions:
    - Wildlife Biology Technician (GS 11). Will assist the Natural Resources Manager in coordinating all natural resource management activities at NAFB and NTTR. The position will be housed at NAFB in the Environmental Management Office and will assist with the implementation and establishment of natural resource programs.
    - Botanist (GS 11): Assist the Natural Resources Manager in coordinating all activities for natural resource management at NAFB and NTTR. The position will be housed at NAFB in the Environmental Management Office
- By December 2008, add two new staff positions (Biologist/Botanist) to support natural resources management at NTTR and NAFB. Both positions will be technical level positions at GS 9 to GS 11. Both positions will be housed at NAFB in the Environmental Management Staff Office working directly for the Natural Resources Manager. These positions will be developed to provide additional field support for coordination of contractor activities as well as conducting day-to-day field operations and maintenance for natural resources management. Responsibilities will include fieldwork as well as analysis and summarization of data and production of reports.

Incorporation of these two new positions into the natural resources management staff will probably allow for a decrease in the required budget for use of contract personnel in the program. Thus, the overall budget for natural resources management could be decreased by as much as 40% by 2010. The Natural Resources Management Program will continue to require outside services, but these could be decreased significantly.

7.3 ANNUAL COORDINATION REQUIREMENTS

As required by AFI 32-7064, the INRMP should be updated annually and revised every five years. It is anticipated that annual updates will mostly involve the incorporation of new and additional data to the natural resources database, which may result in some minor changes in maps and figures used in the INRMP. Additionally, changes in environmental regulations as well as implementation of biological opinions may also impact the INRMP and require some updating.

For annual updates, a letter report describing the changes required for the INRMP will be prepared. The update will be submitted to ACC for review and approval. The report will be added as an additional appendix to the INRMP. Copies of the report will be submitted to the following regulatory agencies following approval by ACC and the Base Commander:

- U.S. Fish and Wildlife Service

- Bureau of Land Management
- Nevada Department of Wildlife

Additionally, copies of the amendment will be sent to any interested agencies or any other regulatory agencies potentially impacted by the update and will be available to the public through Nellis Air Force Base Office of Public Affairs.

Every five years, the INRMP will be revised to include new data collected over the past five years and to accommodate any changes identified during annual updates. Those changes will be incorporated into the body of the INRMP, and any additional changes will also be made. New projects and project budgets will be projected and provided in the implementation section of the INRMP at that time. The five-year revision should involve coordination and discussions between regulatory agencies and the natural resources management staff to ensure that all parties are comfortable with the new INRMP. According to the Sikes Act, the following entities will review and provide signatory approval of the revised INRMP:

- Base Commander
- USFWS
- NDOW

Because of their responsibilities assigned through the Military Lands Withdrawal Act for portions of NTTR, BLM should also be involved in the review process, but are not officially listed for approval of the document. It is the intent of this INRMP to update the 5-Party Agreement, only organizing it differently such that members of the entities that actually interact on a regular basis and are very familiar with the field issues encountered in the implementation of the INRMP are organized into a workgroup. This group will foster a good working relationship between the agencies and will form a partnership to solve natural resource problems on NTTR. An annual meeting should be held with these parties to discuss natural resource management at NAFB and NTTR. The revision to the INRMP may require an environmental assessment if it is determined that significant changes in natural resources management warrant formal NEPA analyses.

7.4 MONITORING INRMP IMPLEMENTATION

On the pages that follow, a spreadsheet is provided to track the completion of projects proposed by the INRMP for the years 2005 through 2011. As part of the annual update for the INRMP, this spreadsheet will be completed by the Natural Resources Manager. In addition to the spreadsheet, the Natural Resource Manager should provide a summary describing accomplishments of that year's projects as well as reasonable explanations as to why projects were not completed on schedule. If necessary, an updated schedule will be prepared as part of the update. The summary should also include a discussion of problems and issues encountered in the implementation of the INRMP as well as methods to improve implementation of the INRMP. As previously discussed, the INRMP update will be approved by ACC and provided to the USFWS, BLM, and NDOW for their files. Methods to improve implementation of the INRMP to meet its goals and objectives should be discussed at the annual meeting with these agencies.

APPENDIX A

PROPOSED DESERT TORTOISE MANAGEMENT PLAN

DESERT TORTOISE MANAGEMENT PLAN

EXAMPLE TABLE OF CONTENTS

EXECUTIVE SUMMARY

1. INTRODUCTION
   - 1.1 PURPOSE
   - 1.2 LOCATION
   - 1.3 HISTORY

2. RANGE USE AND TRAINING PROGRAMS

3. EXISTING PLANNING DOCUMENTS
   - 3.1 BLM NATURAL RESOURCE MANAGEMENT PLAN
   - 3.2 CLARK COUNTY MULTIPLE LAND USE LAND MANAGEMENT PLAN
   - 3.3 INTEGRATED NATURAL RESOURCES MANAGEMENT PLAN
   - 3.4 ENDANGERED SPECIES ACT
   - 3.5 BIOLOGICAL OPINION FOR NTTR AND NAFB
   - 3.6 DESERT TORTOISE RECOVERY PLAN

4. SUMMARY OF RESOURCES
   - 4.1 PHYSICAL ENVIRONMENT
   - 4.2 PLANT COMMUNITIES

5. CURRENT STATUS OF THE DESERT TORTOISE AND HABITAT
   - 5.1 DATA COLLECTION
   - 5.2 GIS DATABASE
   - 5.2 CURRENT ESTIMATES OF ABUNDANCE
   - 5.3 CURRENT DISTURBANCES AND IMPACTS
     - 5.3.1 MILITARY
     - 5.3.2 INCREASED PREDATION
   - 5.4 POTENTIAL FUTURE TRAINING ACTIVITIES

6. MANAGEMENT PLAN
   - 6.1 GENERAL RECOMMENDATIONS
   - 6.2 RECOMMENDATIONS FOR RANGE AREAS
     - 6.2.1 Range 63 and 63A
     - 6.2.2 Range 62S
     - 6.2.3 Range 62N
     - 6.2.4 Range 64A
     - 6.2.5 Range 64B
     - 6.2.6 Range 64C
     - 6.2.7 Range 64D
     - 6.2.8 Range 65S
     - 6.2.9 Range 65N
     - 6.2.7 Range 61E
     - 6.2.7 Range 61W

6.2.7 Range 64D
6.2.7 Range 64D
6.3 MONITORING DESERT TORTOISE POPULATIONS
6.3.1 Desert Tortoise Trend Plots
6.3.2 Line distance Transects
6.3.3 Relative Abundance Transects
6.3.4 Disease
6.4 RESEARCH PRIORITIES
6.4.1 Tortoise Movement and Distribution
6.4.2 Diseases
6.4.3 Limits to Distribution on the South Range
6.4.4 Response of Tortoises to Target Use
6.4.5 Raven Control

7. CONCLUSIONS

8. LITERATURE CITED